1918 Vol. XLVIII SEPTEMBER 13th, 1945

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What is common to all these aircraft?

SWIFT	ALBACORE	MOSQUITO
MONOSPAR	DE HAVILLAND 86B	FIREFLY
ENVOY	HAMPDEN	HUDSON
COURIER	HALIFAX	KITTYHAWK
HART	SWORDFISH	VENGEANCE
DEMON	BOSTON	YORK
GLADIATOR	BUFFALO	DEFIANT
LYSANDER	BARRACUDA	TYPHOON
SPITFIRE	TOMAHAWK	AUSTER
HURRICANE	MARYLAND	VENTURA
BOMBAY	BEAUFIGHTER	ENSIGN
MOTH MINOR	MARTLET	FORTRESS
BOTHA	MANCHESTER	SEA OTTER
BEAUFORT	WARWICK	TEMPEST
WELLINGTON	STIRLING	METEOR
WHITLEY	MASTER	HORNET
OXFORD	HARVARD	SPITEFUL
ANSON	MOHAWK	LINCOLN

The Royal Observer Corps would say that as far as silhouettes are concerned there is nothing common to *all* aircraft. But had this Corps' concern been one of equipment rather than shape, another story would have to be told. For no matter the craft 'spotted,' if it is a British warplane it is fitted with Vokes Filters. And that goes for many of the American 'planes too! On the aircraft listed above will be found one or more Vokes Filters—for Carburettor Air Intake, Lubricating Oil and Fuel System and many other uses—on Air Compressors, Hydraulic Controls for Landing Wheels, Gun Turrets and Wing Flaps, etc.

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FLIGHT
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FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

Japanese Revelations

NOW that the Japanese have no "security" reasons for withholding information they are beginning to talk freely, and some very interesting facts have been revealed. At the recent meeting of the Diet it was stated that in June, 1944, Japanese aircraft production reached a peak of 2,857 machines a month, but that by July last it had dropped to 1,003. It was not stated how much of this drop was due to American bombing. It was only in the last few months of the war that the Americans were in a position to carry out a sustained bombing programme against Japanese war production, and there were other things besides aircraft whose outturn needed to be curtailed. As we have remarked before, once the tide had begun to turn against them the Japanese seemed to lose their air sense as well as their sea sense.

Vice-Admiral Kanabewa has stated that the fleet which was defeated by American carrier-borne aircraft in the Coral Sea was heading for Port Moresby in New Guinea, and was followed by a number of transports carrying troops destined for the invasion of Australia. After that extraordinary battle the Japanese showed that they had lost all confidence in their once formidable sea power and air power. Both had been used cleverly in the initial sweep forward, but both ceased to be props once the Japanese had to change their strategy from advance to holding their gains. In that altered condition of affairs only their Army maintained its reputation for sticking things out.

Shipbuilding centres in Japan have been found to be relatively undamaged. The Americans explain that they left them more or less alone because there were many targets of greater importance, and the Japanese Navy was not expected to play an important part in the concluding stages of the war. This estimate was well justified. Bombers and submarines took such a heavy toll of Japanese carriers, cruisers and destroyers that towards the end it would have been impossible for the enemy to venture on a fleet action. Battleships cannot fight without the support of those three classes of warship. And so it finally came about that the last remnants of the once-mighty Japanese Navy were sunk unresisting in their home harbours by the bombs of the Americans and British.

Smith Square Says So

INTERNAL airways of Great Britain will, if the Trades Union Congress has its way, be lumped together with such fast-moving traffic as lorries, tramps and canal barges. The proposal put before the Blackpool Congress advocates the setting-up of a National Transport Authority under the Minister of Transport. This would be a Public Corporation whose chairman would be chosen for his proved ability and experience gained "on the job," and to which subsequently (we quote) "it might be appropriate to add the chairmen of the seven operating Boards (i.e., Railways, Road Haulage, Road Passenger Transport, Canals and Inland Waterways, Ports and Docks, Coastwise Shipping, and Inland Airways)."

The suggestion is made that as regards the financial transfer of undertakings to the N.T.A. compensation for the present owners should be calculated by reference to "Reasonable Net Maintainable Revenue." Just how this will be ascertained in the case of the inland airways is not explained.

"Organised with vision and drive," the report states, "there is scope for considerable expansion in internal air transport." The four main requirements for development may be summarised as: sufficient and adequately equipped airfields; suitable aircraft up to the best foreign

standards; liberally financed technical research; and "a suitable organisation for the control of civilian flying and its development in association with other forms of transport." All very praiseworthy, but the ways and means suggested do not impress us. Briefly, it is proposed that, although the acquisition of the railways would provide a public financial interest in the British European Corporation suggested in the Churchill Government's White Paper last year, it is necessary that "a more positive line be taken." The T.U.C. report recommends that:—

> All internal airlines, including those to the Continent, be immediately acquired for operation by a public Board, which should also be responsible for the operation of the necessary airfields in close association with local authorities. The Ministry of Civil Aviation would be required to assist in this reorganisation in co-operation with the Ministry of Transport. It is anticipated, however, that the Board would ultimately become a constituent part of the National Transport Authority.

The fate of the Ministry of Civil Aviation after it has "assisted in this reorganisation" is not made clear, but on the face of it one is left with the impression that the suggestion is that the Ministry is to help dig its own grave.

Just why a newly established Board should know better than a department which has specialised on the work for years how to control the internal airlines, including those to the Continent, is difficult to understand, and the whole suggested scheme strikes us as being thoroughly impractical.

The Battle of Britain

THIS week-end we are commemorating the fifth anniversary of the height of the air battles which have become immortal under the name "Battle of Britain." The general public will, for the first time since 1939, be admitted to a number of R.A.F. air stations, and the thrill of seeing our various aircraft types close-up and in action will arouse proud memories of those perilous days when "The Few" saved this country and thereby the world. Many lives were lost in that series of air fights, and our thoughts will go out to them in gratitude. Of them it may in truth be said that they did not die in vain.

It is fitting that on this occasion we should also pay a tribute to the mechanical equipment which made that glorious victory possible. The Hurricanes and the Spitfires shared the honours on that memorable September 15th when a total of 185 German aircraft were brought down. The ratio was something of the order of three by Hurricanes and two by Spitfires, the reason for this being that of the 51 squadrons which the R.A.F. sent into action, 32 were equipped with Hurricanes and 19 with Spitfires. That there were so many Hurricanes available was due to the decision of the Hawker directors in March, 1936, to go ahead with production of the Hurricane, although the official order was not received until June. Had they delayed in order to improve the Hurricane's performance (it did 335 m.p.h. against the Spitfire's 366 m.p.h.) we might not have had enough fighters for the Battle of Britain.

What made the Hurricanes and the Spitfires possible was the Rolls-Royce Merlin engine, of which the Germans had not then, nor at any stage of the war, a comparable equivalent.

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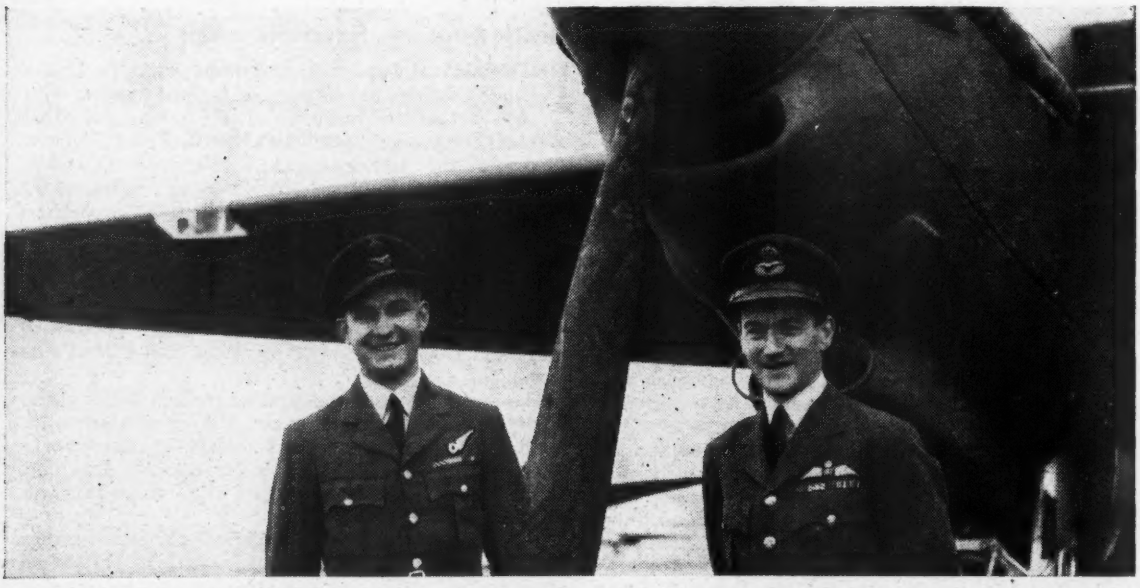
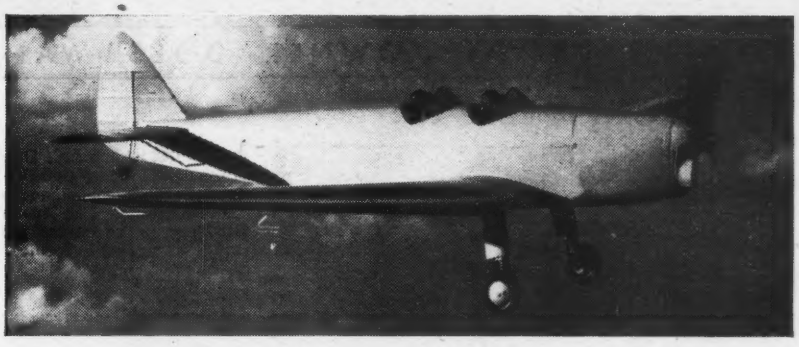


FASTEST-EVER TO NEWFOUNDLAND: Wing Commander J. Merifield, D.S.O., D.F.C. and Bar (right) with his navigator, Flight Lieutenant J. H. Spiers, D.F.C., D.F.M. in front of the photographic reconnaissance Mosquito on which they flew from England to Newfoundland in 7 hours 2 minutes. Distance 2,300 miles, average speed 315 m.p.h.



The little Moth Minor is not included by the author, presumably because it was never really in production.

What the Private Owner Does Want!

A Review of Pre-war Types and Some Suggestions

By ERNEST P. BRODIE

IN *Flight* of July 12th, 1945, "Indicator" gave his views on the above subject. It is not, perhaps, out of place to give a somewhat different view from another angle. It is felt that this subject is apt to be wrapped in a certain amount of mystery and the following notes are an attempt to dissolve some of this atmosphere. To put it bluntly, what the private owner does want is a straightforward flying machine with good handling characteristics in the air, on the ground, and in the intermediate processes. It must be capable of transporting one, two, or up to five people economically and efficiently in reasonable comfort so that it shows a balance in favour of aerial transport in time, sensation, comfort, or other fields.

Regarding what machines are likely to be available, that is a different matter, and the only information is rather meagre and based largely on pre-war details. In delving into this the following table emerged, and I feel it may be useful in that it gives a basis for comparison and comment, and might be used for post-war racing and competition if and when that becomes possible once again.

Reviewing the table generally, classes 1A and 1B represent the cheapest form of power flying, and are invaluable for putting in solo hourage and round-the-'drome flying. As no types appear available, it would seem that there is room for revival and development.

Cheap Operation

Classes 1C and 1D are more serious and more expensive designs, but they represent the cheapest form of operation for two, where they are designed for this. It is good to know that the excellent Tipsy will return as soon as possible. It is in this class that our friends from the States will launch a big drive, and a few models are needed to counteract this.

Classes 2A and 2B are likely to be numerous in post-war clubs, and will provide a means to give many people a way to the "A" certificate, but I consider that the type has had its best days, and is not comparable in comfort and performance with the low-wing cabin monoplane.

Class 3A is an ever-popular type which will continue to have its adherents, especially in the U.S. In this country the sole representative is the Auster (originally of U.S. design), and there will probably be others, but again they cannot compete with clean low-wing monoplanes with retractable undercarriage.

Class 4A is usually a more expensive type of aircraft, though why this is so is not quite clear. It should not be any more difficult to manufacture than the high-wing type,

Class No.	Engine H.P.	Brief Details.	No. of Seats.	British Types.	U.S. Types.
1A	Under 40	Powered Glider ...	1	*B.A.C. Drone	—
1B	,,	Derived from "Pou" ...	1	*Luton Minor, *Brawny, *Abbot-Baynes.	—
1C	,,	Low-wing Mono., conventional type.	1—2	Tipsy	Piper Skycycle.
1D	,,	High-wing Mono., fixed U/C.	1—2	*Hillson-Praga	Aeronca and Piper, with 40-h.p. engine.
2A	40—150	Light ex-Trainer Biplane	1—2	*Tiger Moth, *Tutor, *Avian, *Blackburn B2	*PT13 and PT17 Caydet, *Waco.
2B	,,	Ex-Trainer Mono. ...	1—2	*Magister, M18	PT25 Ryan, ‡, PT26 Cornell.
3A	,,	High-wing Mono, fixed U/C.	1—4	*Puss, *Leopard, Auster, *Wicko.	Piper Cub, Stinson 105, Aeronca, Taylorcraft, and others.
4A	,,	Low wing Cabin Mono., Fixed U/C.	1—4	Messenger (M38), *Monarch, *C. W. Cygnet.	Arrow (Aeronca).
4B	,,	Low-wing Cabin Mono., retractable U/C.	1—4	M28, *B.A. Eagle	Globe Swift.
5A	Over 150	Low-wing Cabin Mono., fixed U/C.	1—5	Proctor, *Mentor	. . . . . †
5B	,,	Low-wing Cabin Mono., Retractable U/C.	1—5	—	Fairchild M84, Johnson Rocket, Piper Skysedan.
5C	,,	High-wing Mono., fixed U/C.	1—5	*Heston Phœnix (but had retractable U/C.)	Argus, Cessna, Reliant.
5D	,,	Biplane	1—5	* Hornet Moth, *Waco ...	*Vigilant. Beech 17 (or Traveller). (This has retr. U/C.)
6A	150 or over	Speed or Sports Model	1—2	*Comper Swift, *Mew Gull, *Miles Mohawk and *Hawk Speed Six.	Various Racers of small production.
7A	200 or over	Light twin-engine ...	2—6	*Monospar, *Hordern-Richmond. *Dragonfly.	. . . . . †
7B	Over 400	Heavier De-Luxe type ...	2—8	Oxford, *Envoy, Anson, Rapide, *Peregrine, *Q6.	Cessna T50, Crane, Beech 18 (Expediter), Norseman.
8	Various	Amphibians, Autogiros, Helicopters.	2—6	Cierva C40	Republic, Allied Trimmer, Grumman Gosling, Seabird, Sikorsky R4 and R5.

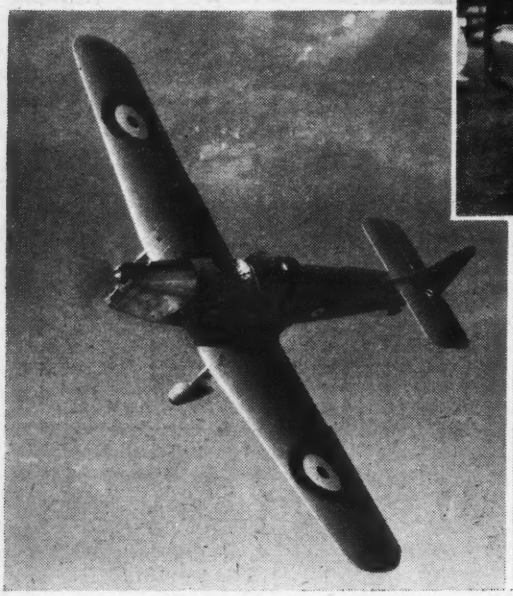
* Denotes no longer in production, or no news of proposed production.

† There may be U.S. types in this class, but no details are known.

‡ Both the Ryan and the Cornell have the 175 h.p. Ranger, but are so much akin to the Magister that they were included here.

WHAT THE PRIVATE OWNER DOES WANT!

On the left, the B.A.C. Drone, the lightest of the light. Below that the Miles Magister. The little Tipsy monoplane (below) was a very smart machine. The Auster, shown below the Tipsy, is the military machine. A civil version is forthcoming



and is considerably cleaner. Unfortunately, there is only one representative in the British division, namely, the civil version of the Messenger.

Class 4B. Here again there is only one British representative, the M28, whereas the Americans recognise the advantages of this type and provide several models.

Sole British Representative

Classes 5A and 5B, 5C and 5D are usually heavier and more fully equipped machines, capable of flying almost anywhere and useful as taxi machines. Britain has only one representative in all these classes which is in production at the moment, though that is an excellent example. (The Proctor.) It was thought advisable to include two almost unique types here, rather than suggest that a separate class should be made. I refer to the Heston Phœnix and the Beech 17, both very good aircraft but alone in their respective classes by virtue of their retractable undercarriages.

Class 6A is a "Sports" type and should be in great demand by ex-R.A.F. pilots and others who still expect a turn of speed. There is no news of production of any of these pre-war types, excellent as they were. It would appear that a Miles Mohawk with a retractable undercarriage would be an extraordinarily attractive revival. If an attempt were made to keep the aircraft simple, it need not be necessarily expensive. I have an idea for the simple mechanical retraction of the undercart, while flaps operated by a direct lever as on the Auster should be reasonable to manufacture and fit.

Class 7A is the type which should fit some of "Indicator's" ideas. Unluckily, once more, there is no news of proposed production of any of these types, while the U.S gives no news either in this class.

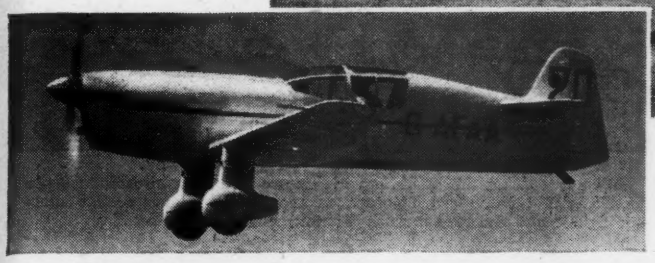
Class 7B. There should be a number of these available as surplus from R.A.F. (if that question is ever settled.) Operating costs would be heavy, but there is no reason why six or seven enthusiasts should not club together and own an Anson or an Oxford for faster flying and touring in a party. The faithful Rapide is so useful that it would appear to be unobtainable for private purposes. However, when the Dove takes its place, perhaps the Rapide will come off priority and be available again.

Class 8. These types are likely to appeal only to wealthy

The General Aircraft Cygnet was extremely easy to fly, and it is to be hoped that it will be revived.

WHAT THE PRIVATE OWNER DOES WANT!

The Percival Proctor is a militarised Vega Gull and re-civilising should not be difficult. The Mew Gull (below) might appeal to sportsmen.



enthusiasts in certain circumstances. The helicopter, well advanced as it is, is not everyman's aircraft yet, and is not suitable for average use. With light amphibians there is always a loss of performance, but this may be outweighed by their advantages for people whose only available "airfield" is a lake or harbour.

Reviewing the situation generally, it is amazing to note how few types are likely to be available in this country, and how many excellent machines have faded from sight. It seems to me that there is room for a great expansion and development. After the lessons of this war, a great deal could be done to flow-produce some standard designs by means of alloy pressings, moulded plastics, or plywood.

Low-power Engines Needed

The question of engines has an important bearing on this subject, and it is unfortunate that, here again, such engines as the Sprite, Pixie, Anzani, Walter Mikron, and Praga have faded out. There is definitely a market for a good 40 h.p. British engine, and probably one for a 60 h.p. also.

Were I in the fortunate position of being a manufacturer-designer (which I am not!), I should concentrate on flow-production of the following types:

Class 1B. Similar to the Luton Minor. 1-seater 40 h.p. Could be produced for £350-400.

Class 1D. Similar to the Hillson-Praga. A *non-strutted* high-wing type, 2-seater, 40 h.p. £800-900. This machine would also fall into class 3A.

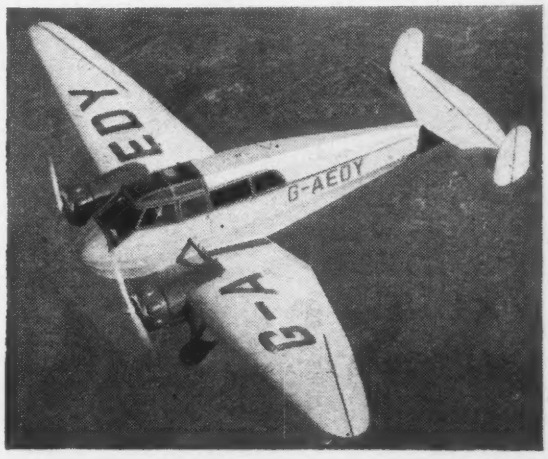
Class 4B. Full 4-seater low-wing cabin aircraft of car comfort. 150 h.p. Simple, mechanically retractable undercarriage and flaps as mentioned previously. Similar to the B.A. Eagle but more of a "Utility" model. No reason why price should be more than £1,000-1,200.

Class 6. Sports speed model. Similar to the Miles Mohawk, but with the simple, mechanically retractable undercarriage. Aerofoils, etc., could be the same as the four-seater, but the fuselage would be much slimmer and more streamlined. With 150 h.p. engine price £1,000-1,200, with Gipsy Six £1,500-1,600.

Class 7B. A rugged twin-engined machine, low-wing, two Gipsy Sixes, undercarriage could be retractable or not. Extensive flaps, and capable of hauling 1,200-1,500 lb. or 6-8 passengers. This being the answer to "Indicator's" suggestions Price £4,000-6,000.

Regarding other points mentioned by "Indicator," the shape and position of the screen, behaviour with flaps and on the ground, it should not be difficult to incorporate them in the above models. A tricycle undercarriage could be fitted to the Class 7 machine, but it would be difficult to fit to the single-engined machines, and not very advantageous.

Doubtless these comments and suggestions are open to debate, but I do feel convinced that the suggested types are the ones that could be sold if they were manufactured. Here's hoping that the days of private flying are not far off now.



General Aircraft's Monospar was a handy machine, and the Pobjoy engines were very light for their power.

MOSQUITO'S ATLANTIC RECORD

A MOSQUITO aircraft of the Photographical Reconnaissance Unit stationed at Benson, near Oxford, last week flew from St. Mawgan, near Newquay, Cornwall, to Torbay, Newfoundland, in 7 hr. 2 min. This is the fastest east-to-west crossing of the North Atlantic so far recorded.

The aircraft was on a duty flight to a R.C.A.F. station and was piloted by Wing Cdr. J. R. H. Merifield, D.S.O., D.F.C. and bar, a native of Southampton, and was navigated by Flt. Lt. J. H. Spires, D.F.C., D.F.M., of Luton. Both are 25 years of age.

It is reported that when Flt. Lt. Spires was getting into the aircraft he was asked how long the flight would take and jokingly replied, "Seven hours and one minute." This same officer, it so happens, acted as guide to *Flight's* representative when he visited Benson R.A.F. station the day before the flight. He mentioned the coming flight on the morrow and said then that they hoped to do it in about 7 hr., though the weather was not expected to be any too helpful.

Although this time knocks five hours off the previous best time for an east-to-west crossing, the Atlantic has been crossed in the opposite—and much easier—direction in 6 hr. 20 min. This was achieved by a Liberator of B.O.A.C., flown by Capt. W. S. May in May, 1943.

HERE AND THERE

GERMAN JETS : Preparing the exhibition of captured German aircraft in Hyde Park, London, which include two jet-propelled types ; the Me 163 rocket interceptor fighter and the He 162 with jet unit on top of the fuselage.

Visit to S. Africa

AIR CHIEF MARSHAL SIR ARTHUR HARRIS, whose retirement from Bomber Command of the R.A.F. was announced in last week's issue of *Flight*, left England by air on September 3rd on a visit to Africa at the invitation of the Government of the Union of South Africa and the Government of Southern Rhodesia.

Hyde Park Demonstration

EIGHT enemy aircraft, including the rocket-propelled Messerschmitt Me 163 and the curious-looking jet-propelled Heinkel He 162 (both of which can be seen in the adjacent picture) are to be exhibited in Hyde Park, London, from Sunday next, September 16th ("Battle of Britain" Sunday), until the following Saturday, September 22nd.

The Pathfinder Association

AIR VICE-MARSHAL D. C. T. BENNETT, who founded and commanded the R.A.F. Pathfinder Force of Bomber Command, has been elected first president of the recently formed Pathfinder Association, Ltd., the primary objects of which are to carry on the wartime spirit of fellowship and enable its members to keep in touch with each other in peacetime. The Association has an appointments bureau to help members in obtaining post-war employment.

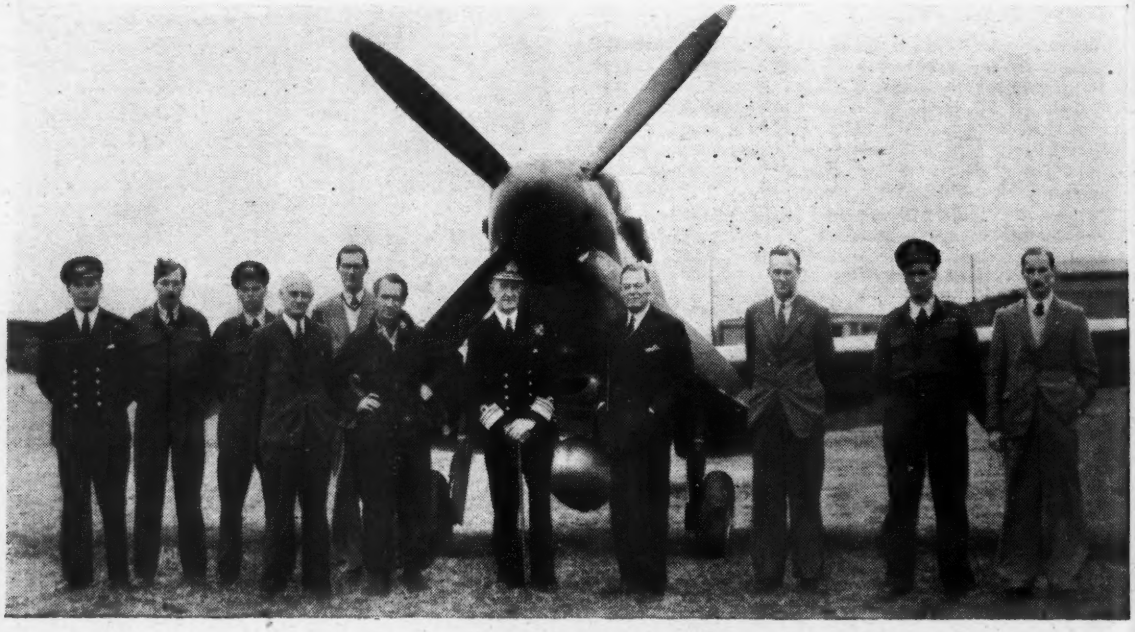
A. V.-M. Bennett is also chairman of the Association's council, members of which include Group Capts. T. G. Mahaddie, P. H. Cribb, G. F. Grant, E. H. Womersley and R. W. Cox, Wing. Cdr. J. C. Macgown, and Sqn. Ldrs. H. Hemming, C. L. Yelland and E. G. Brant (secretary).

The registered office is at 115, Mount Street, Berkeley Square, London, W.1.

R.Ae.S. in Birmingham

TWO of Birmingham's recently elected M.P.s were among the guests at the first annual dinner-dance held on September 1st by the branch of the R.Ae.S. formed not long ago in that Midland city; they were Ald. P. L. E. Shurmer (Sparkbrook) and Counc. J. Silverman (Erdington), both of whom made speeches.

Stressing the wealth of technical skill collected by the Birmingham aircraft industry during the war, Mr. Silverman urged that the city should become a centre for civil air transport lines, and thought that the local branch of the



SUPERMARINERS : Some personnel of the Supermarine High Post Experimental Airfield. From left to right they are :—Lt. Cdr. J. Cooper, R.N., Flt. Lt. P. Hillwood, D.F.C., Flt. Lt. D. Wigley, D.F.C., Mr. J. Smith, chief designer, Flt. Lt. P. Shea Simmonds, M.B.E., Flt. Lt. J. K. Quill, O.B.E., A.F.C., chief test pilot, Adml. (Air) Sir Dennis Boyd, C.B., C.B.E., D.S.C., R.N., Sqn. Cdr. Sir James Bird, O.B.E., R.N.A.S., general manager, Mr. E. Mansbridge, Flt. Lt. T. A. Burke, D.F.C., and Sqn. Ldr. W. J. G. Morgan, D.F.C.

HERE AND THERE

R.Ae.S., whose health he proposed, could assist in this sphere. Mr. Shurmer urged the need to free Elmdon airport for municipal operation as soon as possible.

Over 200 people attended the function, held at the Botanical Gardens, Edgbaston, and these included representatives from most of the leading factories in the city.

Well-earned Awards

THREE young W.A.A.F. officers who parachuted into France before D-Day to work with the Maquis have been awarded the M.B.E. They are Section Officer Sonia D'Artois (*née* Butt), a London girl, who married the French Canadian officer with whom she jumped; Section Officer Maureen O'Sullivan, of Dublin, and Section Officer Phyllis Latour, of Bulawayo, South Africa. The first-named girl acted as a courier in the Le Mans district, and the other two worked as wireless operators near Limoges and in Normandy respectively.

The U.S. shoulder patch being issued to their atomic bomb personnel.

R.A.F. Gliding Club

SOME weeks ago a number of fighter pilots of No. 84 Group, B.A.F.O., amused themselves by making experimental "flips" in a captured German glider at Salz Gitter, a village near Brunswick. This led to the formation of a gliding club for R.A.F. and Army personnel which is reported to be rapidly growing in popularity, so much so that within a month no fewer than 62 soldiers and airmen have taken up the sport and there is now a long waiting list for instruction.

Apparently the idea is spreading, for it is expected that other clubs will be started elsewhere in Germany when intended instructors have been through a five-day course at Salz Gitter.

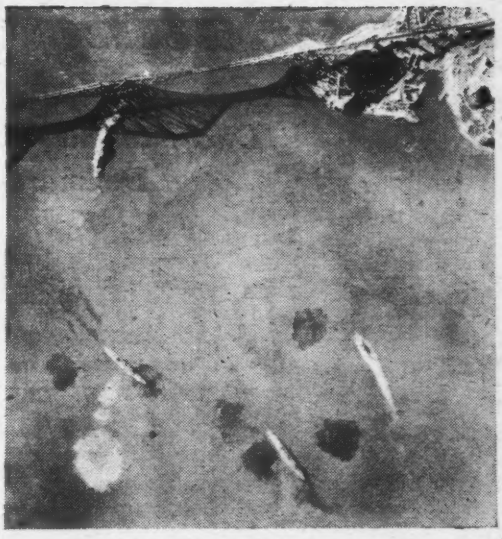
German equipment is, of course, being used, and the club now has five types, including a primary trainer and such well-known sailplanes as the Grunau Baby and Buzzard.

Incidentally, the present soaring record for the club stands at 3hr. 40min., and one "pupil"—a fighter pilot—stayed up for 52min. on his very first flight in an engineless aircraft.

U.S. Nomenclature

A LIST of American warplanes recently published in *Flying* mentions a number of aircraft of which nothing had been said previously.

Among them were the Consolidated P4Y Corregidor, of which only one was built; the Grumman F8F Bearcat, a fighter based on the Wildcat; the Northrop XP-56, a magnesium flying wing, not in production; and the C-79, U.S. name for captured three-engined Ju 52 transport.



MISSED! A captured German photograph of the very first attack on the British mainland—shipping in the Firth of Forth, Oct. 16th, 1939. The dark patches on the water show the nice misses.

News in Brief

WING CDR. LORD MALCOLM DOUGLAS-HAMILTON has been appointed commandant of the A.T.C. in Scotland in succession to his brother, the Duke of Hamilton.

* * *

A new record for the non-stop flight from Honolulu to Washington was recently set up by a B-29 Superfortress which covered the distance in 17 hr. 21 min. Previous best time was 20 hr. 15 min.

* * *

Production of the Luscombe Silvaire "all-metal personal airplane" is to be resumed immediately at the makers' Dallas and Trenton plants, and at least 1,000 of these high-wing light aircraft are scheduled to be completed at Dallas by the end of the year.

* * *

Flight index for Volume 47, January-June, 1945, is now ready and can be obtained at 1s. 1½d. including postage, or with binding case at 4s. 10d. Readers' copies can be bound in the publisher's case with the index at an inclusive charge of 13s. 3d., but present conditions may cause some delay in fulfilling orders.

* * *

Mr. R. K. Pierson, C.B.E., B.Sc., A.M.I.C.E., F.R.Ae.S., has been appointed chief engineer of the aircraft section of Vickers-Armstrongs, Ltd., and Mr. G. R. Edwards, B.Sc., A.F.R.Ae.S., A.M.I.Struct.E., chief designer at the company's Weybridge works, both as from September 1st, 1945.

* * *

Charles E. Thorp, publisher of *Aerosphere Inc.*, New York City, has been appointed executive editor and publisher of the aviation annual on the resignation of Glenn D. Angle from the editorial chair. Lucien Zacharoff becomes editor of the aircraft section of *Aerosphere*, and Louis Bruchiss editor of the engines section.

* * *

When the Duchess of Kent returns from holiday some time next month she will receive the cheque for £250,000 subscribed in South Africa for the R.A.F. Benevolent Fund. Mrs. Jean Hamilton, widow of Lt. Eric Hamilton, S.A.A.F., who was chosen by the spin of a roulette wheel to fly to England with the cheque, also carries a letter to the Duchess from Field Marshal Smuts.

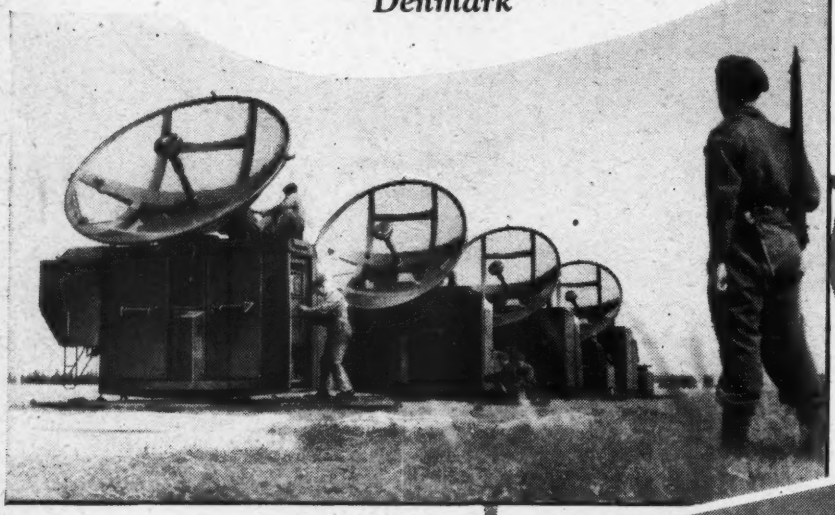
"I can even remember the old horses!"

D

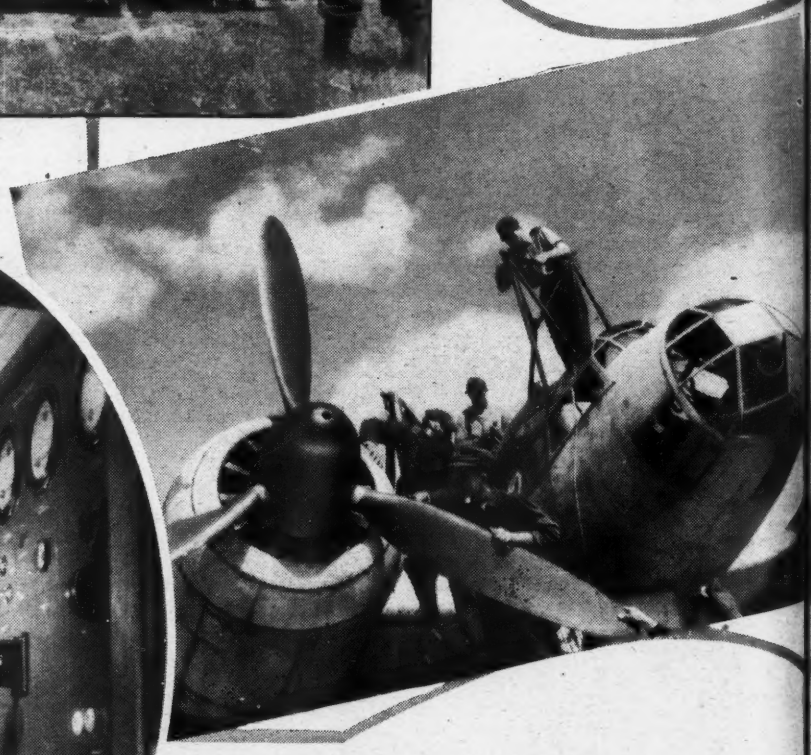
Liquidating the "Luftwaffe"

R.A.F. Experts Direct the Work of the Air Disarmament Wings in Denmark

AMONG the many things which are being done differently—and much better—in dealing with a defeated Germany now, as compared with what happened after the 1914-18 war, is the complete dismemberment of the German Forces. The fundamental mistake of not occupying the homeland of the Hun at the end of 1918 made it possible for his military element to save face by complaining that it had been let down by the people at home and that the German Army had never been defeated in the field. This time the German people could hardly be "sold" that piece of fiction even if there was anyone left to offer it to them, for they see all around



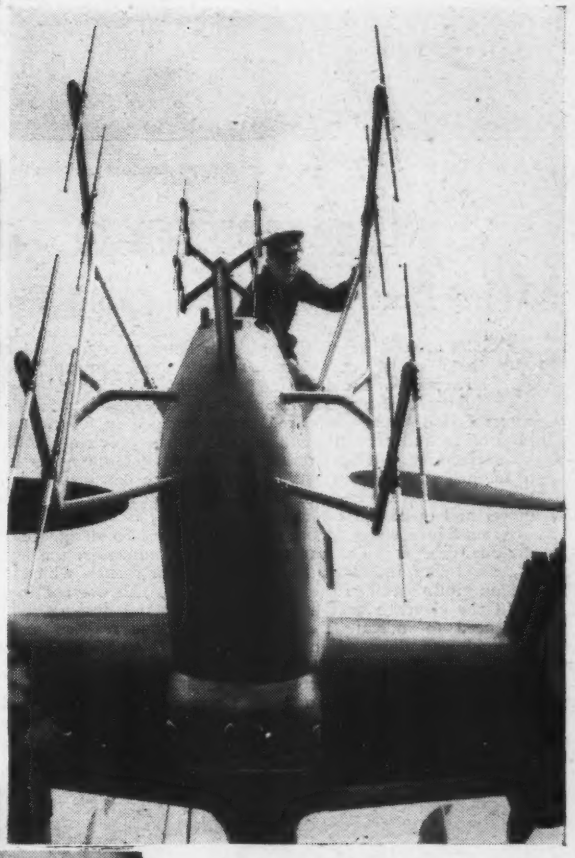
(Below) A German technical officer explains the working of another piece of electrical anti-aircraft equipment known as "Bernhard."



(Above) An example of the Ju 88/Fw 190 pick-a-back aircraft found on the airfield at Tirstrup, Denmark. German ground crew are here seen dismantling the "trestle" on the Ju 88 which carried the guiding Fw 190. On the outward flight the Fw 190 used fuel from the bomber's tanks and switched over to its own after launching the Ju 88 towards its intended target.

(Top, left) In the German organisation, anti-aircraft defences came under the control of the *Luftwaffe*, and German technicians are here seen assembling captured radar equipment on Grove airfield, Denmark. It is known as the Mannheim listening apparatus and was the type mainly used to detect the approach of Allied aircraft. This falls into the category of equipment required in England for research purposes. The figure in the foreground is an R.A.F. Regiment sentry.

(Left) This double row of Fw 190s lined up at Flensburg with their airscrews removed and awaiting disposal, indicates that the *Luftwaffe* fighter strength was by no means exhausted. Fuel shortage probably grounded them.



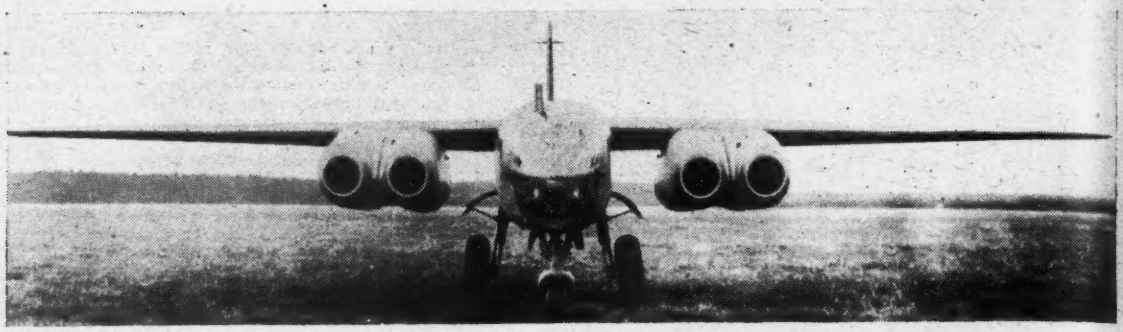
them the most obvious evidence of an overwhelming defeat, including the military machine itself being systematically taken apart by their conquerors before their very eyes.

So far as the *Luftwaffe* is concerned, liquidation is being very thoroughly carried out by the Air Disarmament Wings, working under the direction of the British Air Forces of Occupation, who are using *Luftwaffe* personnel to do the actual work of clearing up, dismantling, sorting and storing their own equipment—the dog is very properly being made to fetch his own muzzle.

These pictures were taken on airfields in Denmark where the R.A.F. experts are directing the important task of disarming and immobilising German aircraft and classifying equipment into various categories. Some of it is wanted in England for technical research (an unfortunate omission in 1918!). A number of German aircraft were also brought to this country for the exhibition in Hyde Park, London, as illustrated on p. 278.

(Above) The German radar equivalent of A.I. may have been efficient but it was not exactly neat, as witness the antennæ of this Me 110 night-fighter being prepared by a German ground crew for dispatch to Britain.

(Left) Few jobs could be better guaranteed to impress the fact of their defeat on the men of the *Luftwaffe* than the one on which this German is engaged —that of painting R.A.F. markings and the words "Air Ministry" on a Messerschmit Me 110 fighter. Whether, after all that has happened to Germany as a result of following another painter in search of world conquest, this particular one has at last learnt the folly of the *herrenvolk* theory one cannot say, but the attitude of the German N.C.O. watching him suggests a resigned indifference. This particular aircraft was one destined to be flown to England by an R.A.F pilot.



Prototype Arado 234c bomber, powered by four BMW 003 jet units.

German Jet Rivalry

More Details of Existing and Projected Turbine-jet Units and Aircraft

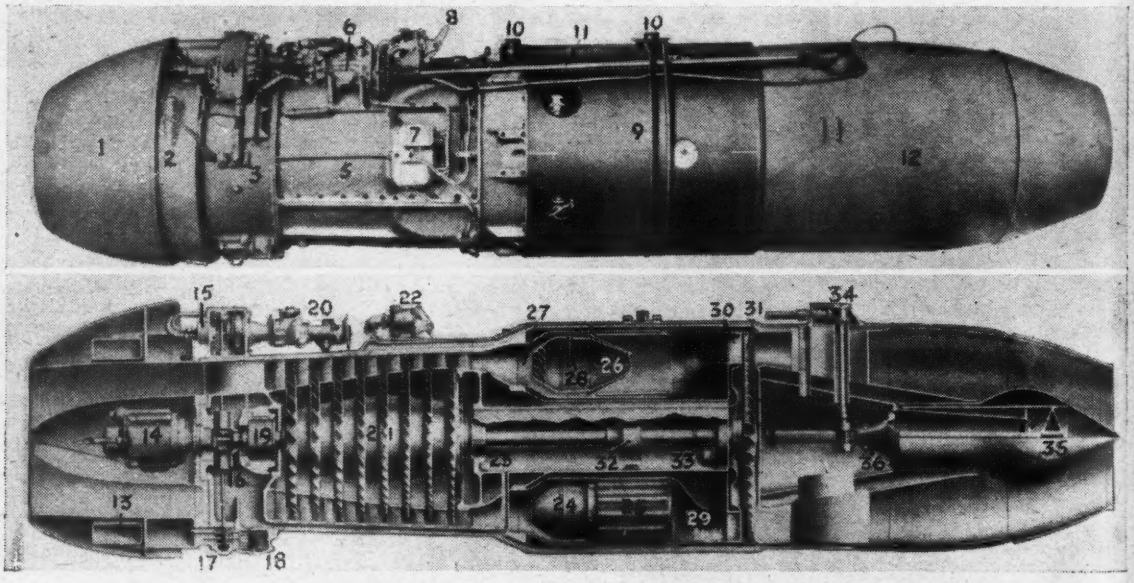
FROM material released by the Air Ministry comes evidence that, whilst the Germans were quick to appreciate advantages offered by jet propulsion, their efforts lacked co-ordination and a sound directive from high level. Manufacturers and designers appeared to be engaged in frantic competition to find an individual solution to the problem of Allied air superiority. With aircraft, engine and jet units this lack of method sharply contrasts with the British policy of concentration and development of proved types to extract the utmost power and operational efficiency.

A six-figure code system was introduced to designate individual designs. The first group of three numerals, 109, gave a general class indication as a turbine-jet or rocket, whilst the second group specified the particular unit. This was continued until the eleventh unit had received its serial number, when the need to indicate the manufacturer was realised and a numeral was allocated to each firm ("1" to Heinkel-Hirth, "2" to Junkers, "8" to BMW), which was used as the terminal figure of the second group.

The first jet aircraft to fly in Germany, and probably the first in the world, was the Heinkel 178, a shoulder-wing monoplane with an experimental Heinkel S3 turbo-jet unit installed in the fuselage. This historic flight was made on August 27th, 1939, four days before the Germans broke into Poland. Curiously, the first test flight of the Italian Caproni-Campini jet aircraft was on August 27th, 1940. The unit had a designed thrust of 1,000 lb. and comprised an axial flow inducer, a radial outflow compressor, an annular, reverse flow combustion chamber and a radial inflow turbine. Constructed purely for experiment and test, the aircraft provided useful data for subsequent productions.

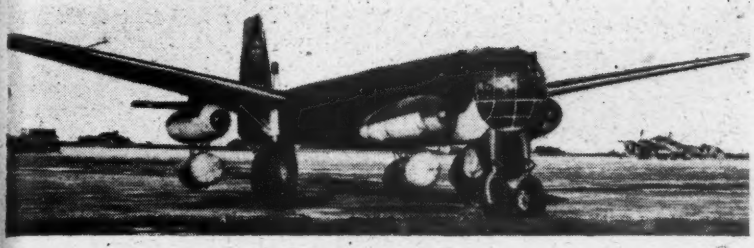
By 1944 Heinkel had produced three experimental jet units and six projected designs. The S8 unit, coded as 109-001, resembled the S3 except for a straight through instead of a reverse flow combustion chamber and developed a thrust of 1,500 lb. Specially designed to accommodate two of these units was the He 280, a single-seater, low-wing monoplane with twin fins and rudders, first flown in 1941. In operation it was slower and less efficient than the contemporary Me 262 and was eventually abandoned. Heinkel also had a projected four-jet monoplane, the He 343, but this never materialised.

The later Heinkel jet unit, designated 109-011, was produced in collaboration with the firm of Hirth Motoren. Although it was never operational, it had been brought to an advanced



Port-side view and longitudinal section of Junkers 004 unit.

1, nose cowling. 2, oil tank. 3, entry casing. 4, auxiliary gear box. 5, compressor casing. 6, servo motor. 7, ignition apparatus. 8, control lever. 9, outer casting. 10, attachment points. 11, bullet control shaft. 12, exhaust casing. 13, annular fuel tank. 14, Riedel starter. 15, injection pump. 16, auxiliary drive. 17, oil pump. 18, oil filter. 19, front compressor bearing. 20, speed regulator. 21, compressor rotor. 22, fuel filter. 23, rear compressor bearing. 24, flame tube. 25, combustion-chamber muffle. 26, diffusing grill. 27, combustion chamber. 28, injection nozzle. 29, turbine entry casing. 30, turbine stator blades. 31, turbine. 32, forward turbine bearing. 33, rear turbine bearing with oil scavenge pump. 34, bullet-operating gears. 35, movable bullet. 36 bullet support.



The first jet-propelled heavy bomber, the Junkers 287.

GERMAN JET RIVALRY

stage of development, as will be seen from the illustration. It has an axial inducer, a compressor with one radial outflow and three axial stages, a single annular combustion chamber with sixteen fuel injectors and a two-stage axial turbine with hollow blades. The jet orifice is varied by a "bullet" adjustable to two positions for idling and power. In emergency this unit could be operated on diesel oil instead of the German standard "light diesel oil."

Probably the most highly developed and certainly the most widely used jet unit was the Junkers 004. The sectional illustration shows the 004 B version, which is representative of all the models from A to E and their sub-types. After initial investigations commencing in 1937, Junkers began full-scale design towards the end of 1939, and the first unit was run in December, 1940. Flight tests were made in an Me 110, and experimental craft a year later, and in the summer of 1943 they were installed in a prototype Me 262. Owing to our bombing attacks, full-scale production was not achieved until the summer of 1944.

Eight-stage Compressor

The eight-stage axial compressor delivers air to six interconnected combustion chambers into which the fuel is injected upstream. Combustion chambers are of aluminised mild steel sheet and are free to slide at their forward ends to accommodate thermal expansion. The single-stage turbine rotor has sixty-one blades of heat-resistant steel of 30 per cent. nickel and 15 per cent. chromium composition. Cooling air is bled off between the fourth and fifth compressor stages and is led to the double skin surrounding the combustion chamber assembly. A small quantity of this air passes into the space between the combustion chambers and the inner wall, but most of it passes down one of the exhaust cone struts to circulate inside the cone and pass through small holes to the downstream face of the turbine disc. Some of it passes into a double skin extending to within about 2ft. of the discharge nozzle. After the last compressor stage, air is bled off internally to tunnels in two of the casting ribs to cool the upstream face of the turbine disc. Further air is taken through three tunnels in the central casting, to the space between the two diaphragms forward of the turbine disc, whence it passes into the hollow entry vanes of the turbine and is discharged through slits in the trailing edges of the vanes. Turbine blades were originally solid, but, due to difficulties of material supply, hollow blades formed from sheet metal were subsequently employed.

As with the other two main German types, Heinkel-Hirth and BMW, the starting system employs a Riedel flat-twin, two-stroke petrol engine, which is mounted in the air intake coaxial with the main shaft. On the ground it can be started by means of a cable and pulley, but in the air it is started electrically from the cockpit. Fuel for the main propulsion unit is light diesel oil. Control of the discharge nozzle is by a "bullet" operated from the throttle lever position and compensated by the pitot head pressure.

The projected 012 unit, intended for the Ju 287 bomber, had an eleven-stage axial compressor and a two-stage turbine. The designed thrust was 6,000 to 6,400 lb. with a specific consumption of about 1.2 lb./hr./lb. The total weight was 4,400 lb. and overall length about 17ft. Up to the time of the German collapse this unit had not been tested.

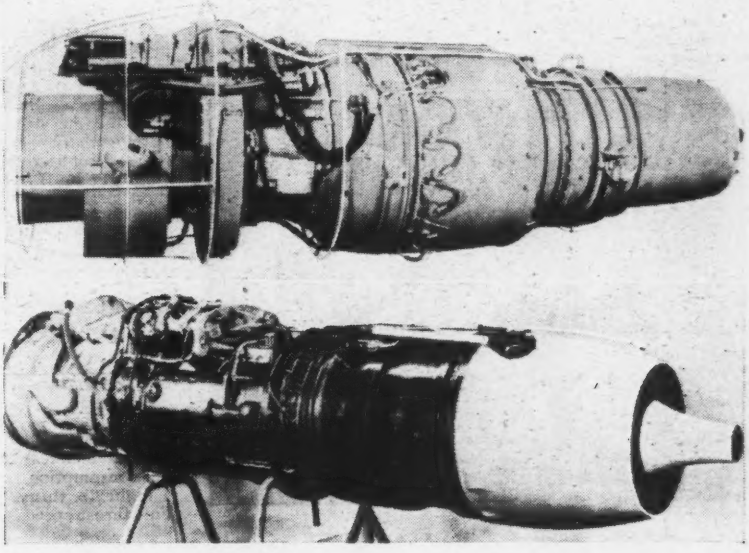
The only other concern to be credited with an operational unit was the Bayerische Motoren Werke. Preliminary studies were undertaken in 1934, work on the B.M.W. 003 was commenced in 1939, and the unit first ran in August, 1940. Instead of the designed static thrust of 1,300 lb. only about 990 lb. was realised, and the specific fuel consumption was 2.2 lb./hr./lb. Since that time considerable improvement had been made, as will be noted from the table on page 284. Component features of the B.M.W. unit, shown in an illustration, are an axial compressor in seven stages, a single annular combustion chamber furnished with sixteen fuel sprayers and a single-stage axial turbine with hollow, air-cooled rotor and stator blades.

Economy of Critical Metals

Control of the discharge nozzle is by the usual "bullet" arranged with four positions for starting, take-off, high speed and cruising. The fuel is light diesel oil or, if necessary, 87 octane petrol.

In this design the utmost care was taken to economise in alloy steels and, in fact, the latest unit only required 1.3 lb. nickel. Similar to other concerns, B.M.W. had big ideas. One project was for a unit having a twelve-stage compressor, a combustion chamber with twenty-four fuel sprays, and a three-stage turbine. This giant, B.M.W. 018, was to develop a static thrust of 7,500 lb., but it was not completed at the cessation of hostilities.

The 007 turbo jet unit was developed by Prof. Leist for the Daimler-Benz concern. One unit was built and run under test in the autumn of 1943. It was of exceptional interest as it possessed a number of unusual features. The compressor and a ducted fan were arranged on two contra-rotating drums. The inner drum had nine stages of compressor blading, whilst the outer drum carried internally eight stages of compressor blading and externally three stages of fan blading. Four tubular combustion chambers were provided, and the turbine rotor was cooled over 30 per cent. of its circumference by air drawn from the ducted fan circuit, whilst the remaining 70 per cent. of the circumference received the working gases.



Above, the Heinkel-Hirth 011 unit with two-stage turbine. Below, the BMW 003 unit with seven-stage compressor.

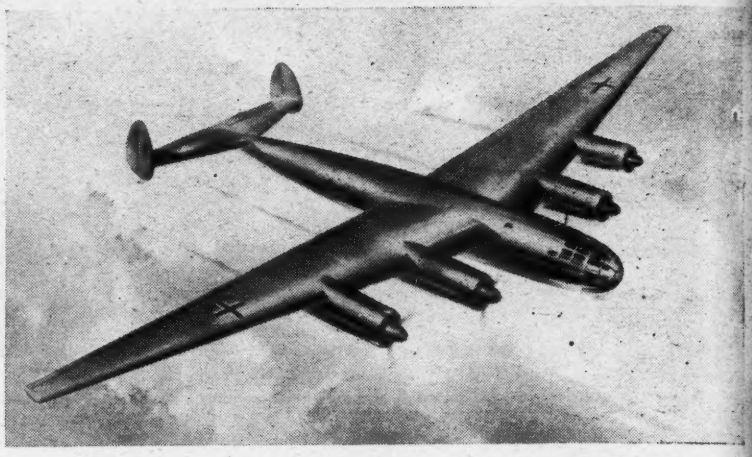
GERMAN JET RIVALRY

Whilst it has become almost axiomatic that the German mentality was never disturbed by complexity of design or production, this unit, despite its undoubted technical interest, was turned down by the German Air Ministry. Work on the project was stopped, and later Daimler-Benz were given the task of adapting the Heinkel 011 unit for driving an airscrew.

Towards the end of the war the development of turbo-jet and airscrew combinations was being actively pursued. As mentioned, the Heinkel 011 was to be adapted by the Daimler-Benz concern. The designed output at the airscrew was 3,300 h.p. at a flight speed of 560 miles per hour.

The Junkers Company had a projected design based on their 012 unit. This was to be modified by the provision of gearing for contra-rotating airscrews and was to be known as the 022 unit.

A third example, also an uncompleted project, was a conversion of the ambitious B.M.W. 018 unit to drive contra-rotating airscrews. An additional stage was added to the turbine, making a total of four, and the drive was taken off the compressor shaft and transmitted through planetary gears. It was expected that 7,700 h.p. would be delivered to the airscrew shafts.



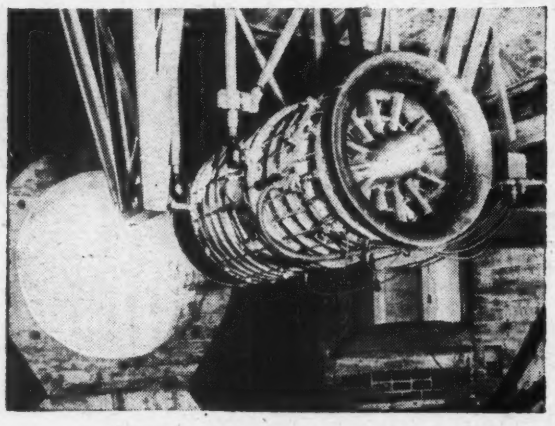
Artist's impression of the Messerschmitt Me 264 long-range bomber.

A Jet-propelled Bomber

For short-range operations the jet-propelled bomber was attractive by reason of its high speed. However, owing to difficulties created by the Allied bombing programme, only one aircraft actually became operational. This was the high-wing Arado 234B, a light bomber and reconnaissance type, first flown in December, 1943. Developed from the experimental Ar 234A which had a jettisonable undercarriage, it had a wing span of 47ft. and a take-off weight of 18,500 lb. which could be increased to 22,000 lb. with rocket take-off. Two Junkers 004 jet units were underslung from the wing, and tank capacity was 836 gal. As a reconnaissance craft it had a maximum speed of 470 m.p.h. at 18,700ft. and a service ceiling of 37,700ft. Normal bomb load was 2,200 lb., but a maximum load of 4,400 lb. could be carried. As bombs were slung externally the maximum load reduced the speed by about 60 m.p.h.

More interesting was the 234C. This was the 234B with slight modifications and powered by four B.M.W. 003 jet units arranged in two twin nacelles under the wing. It only reached the prototype stage, but had been proved to possess good inherent stability in addition to a high performance. Rate of climb was 3,600 ft./min. with a maximum level speed of 546 m.p.h. at 20,000ft. and a service ceiling of 37,800ft. Endurance was 40 min. at full thrust or 85 min. at 60 per cent. thrust, but these figures could be improved by the employment of drop tanks.

The first jet-propelled heavy bomber ever to fly, again only as a prototype, was the Ju 287. It was exceptional in having a wing form which swept forward at approximately 25 deg., presenting a very unconventional appearance. This feature was claimed to be of advantage aerodynamically and to improve handling characteristics at low speeds. The span is 66ft. and the total wing area 628 sq. ft. Carrying a load of 6,600 lb. of bombs, it had a range of 1,175 miles and a maximum speed at 16,400ft. of 537 m.p.h. The maximum bomb load which could be carried was 9,900 lb. It was initially designed to be powered by two large turbo-jet units, either Junkers 012 or B.M.W. 018. As these units were not ready for installation, various arrangements of four or six smaller jet units already in production were employed. In some instances all the jet units were mounted under the wings, either singly or in groups, whilst in others one unit was mounted on each side of the fuselage nose and the remainder slung under the wings.



Exper mental Daimler-Benz unit on test.

Power Boost Schemes

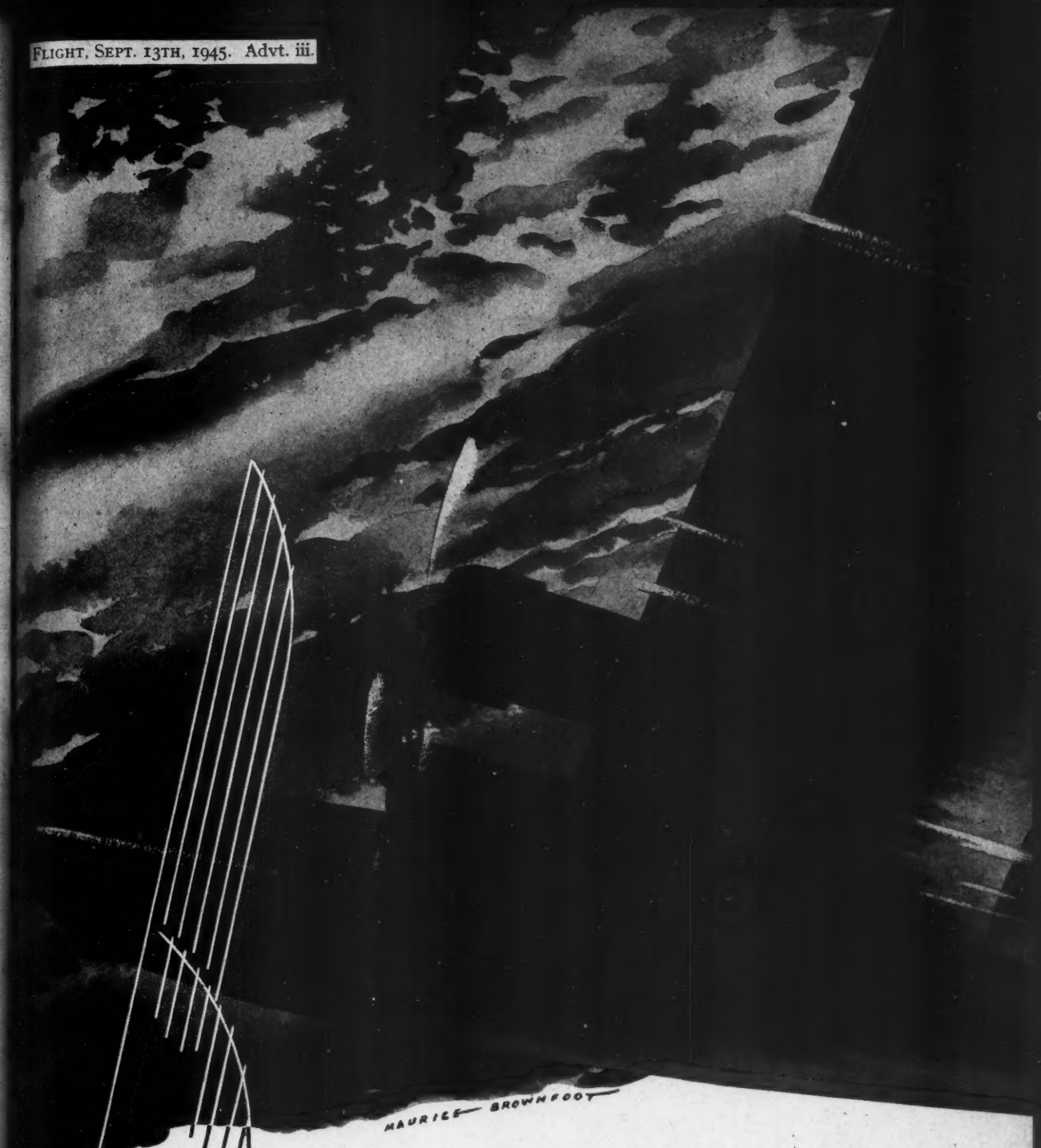
The Germans displayed considerable interest in schemes for obtaining a sudden burst of power for short periods. This is understandable in view of their tactical requirements. In the case of interceptors, extra power was necessary to increase the rate of climb, fighters needed it for evasion, and bombers for take-off. In most cases their machines required a temporary margin of performance to give them a reasonable chance of survival against the attacks of Allied aircraft. Apart from ingenious methods of boosting power by the injection of methanol-water, ethanol-water, pure water, and nitrous oxide gas into the eye of the supercharger and the injection of petrol into the air intake, they aimed to utilise liquid rocket and turbine jet units for this auxiliary service.

The most interesting example of this was the Me 264 long-range bomber with which it was ultimately hoped to raid New York. This was a most promising design, somewhat resembling in outline a large Liberator. It had a wing of exceptionally high aspect ratio with a span of 141ft. Armament and equipment were sacrificed in order to attain maximum range, and to support its tremendous weight at take-off a pair of extra wheels were provided which were jettisoned as soon as the craft became airborne. It was first flown in December, 1942, but fortunately it was never developed beyond the prototype stage. For test it was fitted with four Jumo 211 engines, but Jumo 213 or B.M.W. 801 were intended for installation. For short period bursts of high speed, two B.M.W. 603 jet units were to be provided, one under each main plane.

Similarly, Focke-Wulf also had a design for a six-engined bomber, the Ta 400, which was handed over to S.N.C.A.O. in Paris for development.

PARTICULARS OF THREE GERMAN JET UNITS

	BMW 003	JUMO 004 B	HEINKEL-HIRTH 001
Sea level static thrust, lb. ..	1,760	1,890	2,860
Weight, lb. ..	1,250	1,585	2,090
Overall length, ft...	11.6	12.7	11.5
Max. diameter, ft...	2.26	2.64	2.87
Sp. consumption, lb./hr./lb. thrust	1.47	1.4	1.31
Full thrust speed ..	9,500 r.p.m.	8,700 r.p.m.	11,000 r.p.m.

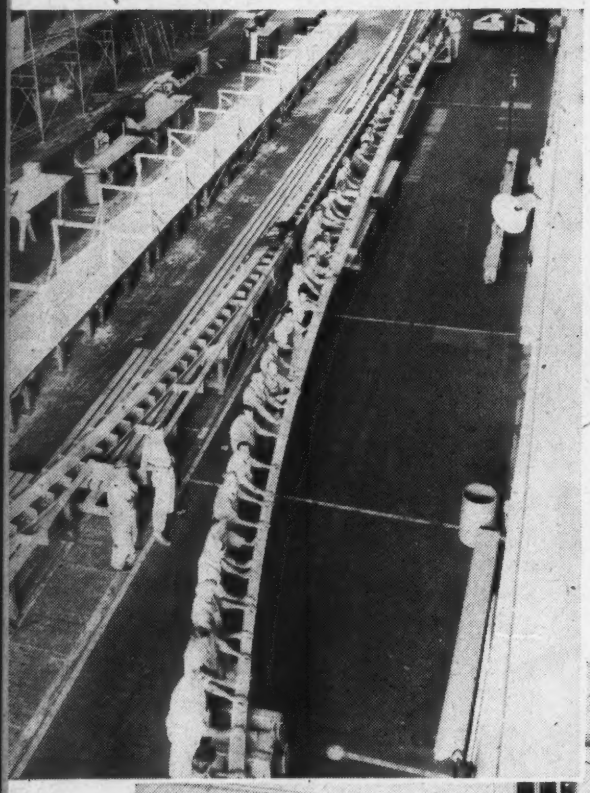


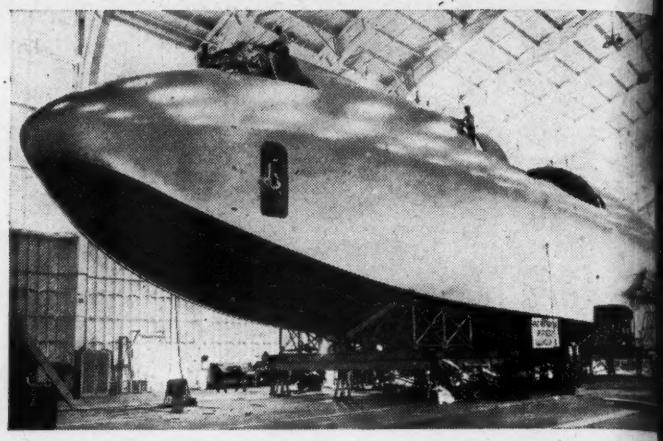
MORRISONS

CROYDON

CONSTRUCTION, MAINTENANCE AND REPAIRS

Smee's

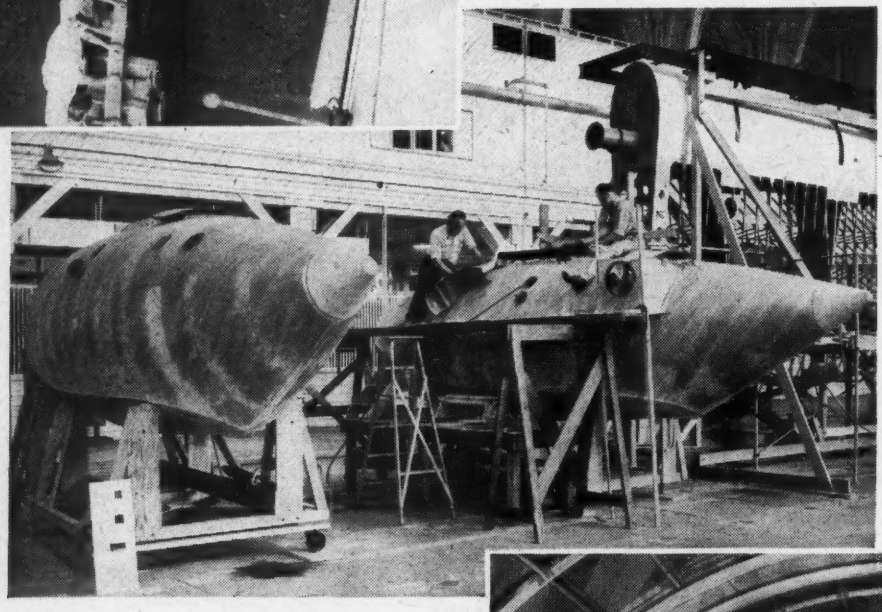




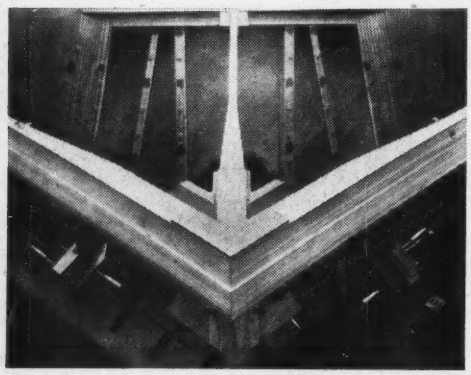
The wooden hull is 220ft. long. On the left, one of the top hull longerons [illegible] made ready for the jig

The Kaiser - [illegible]

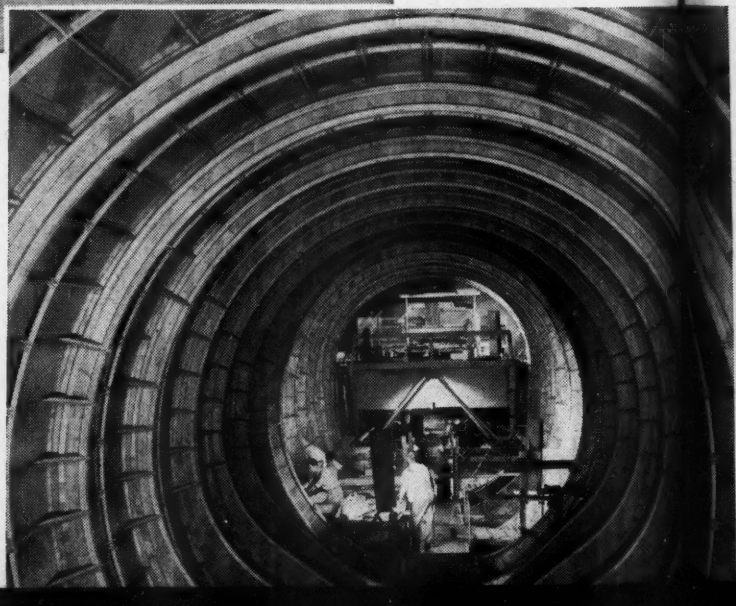
Giant American Flying Boat Built Entirely [illegible] Spa[illegible]

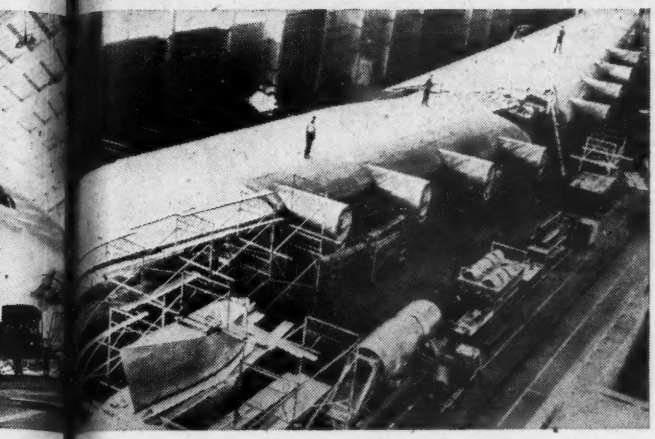


THAT a flying boat of 400,000 lb. gross weight should be at all possible in wood construction seems surprising. The Hercules shown on these pages is so constructed, the reason being that it was initially planned when wood was plentiful while light metals were in short supply. It appears doubtful that the designers would have chosen wood if the work were being started now. Nevertheless, they have, it seems, solved their problems successfully, and the results will be watched with interest.

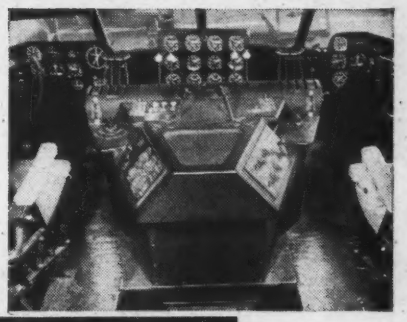


Multi-ply joint in nose of hull. Above that the wing-tip floats. On the right a view inside the 30ft.-high hull. The wooden frames are made of birch

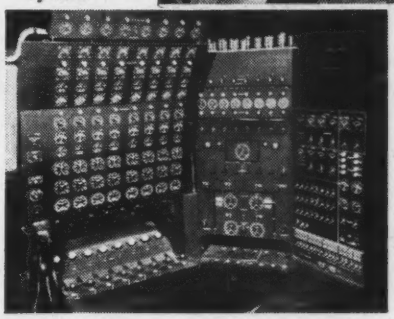




...wing has a span of 320ft. and is of wood construction. So are the eight engine nacelles



On the right is shown a mock-up of the pilots' compartment. The eight throttles are the only engine controls in this compartment, but even so they must be a "handful." They are operated by the Pneudyne system



An eyeful for the flight engineers. Mock-up of the instrument panels and various engine controls which relieve the pilots of all but the throttle controls

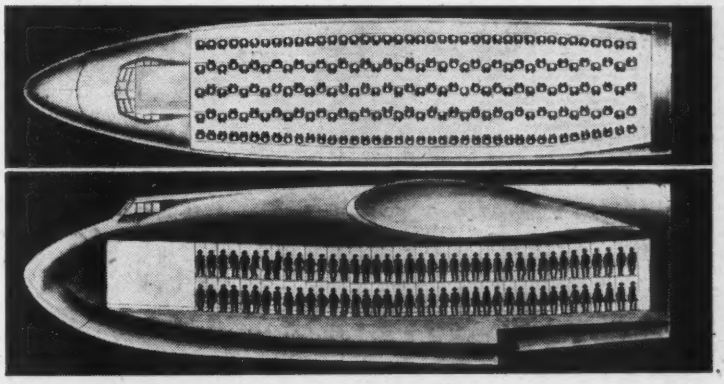
...hes Hercules

...rely ... Span 320ft., Loaded Weight 400,000 lb.

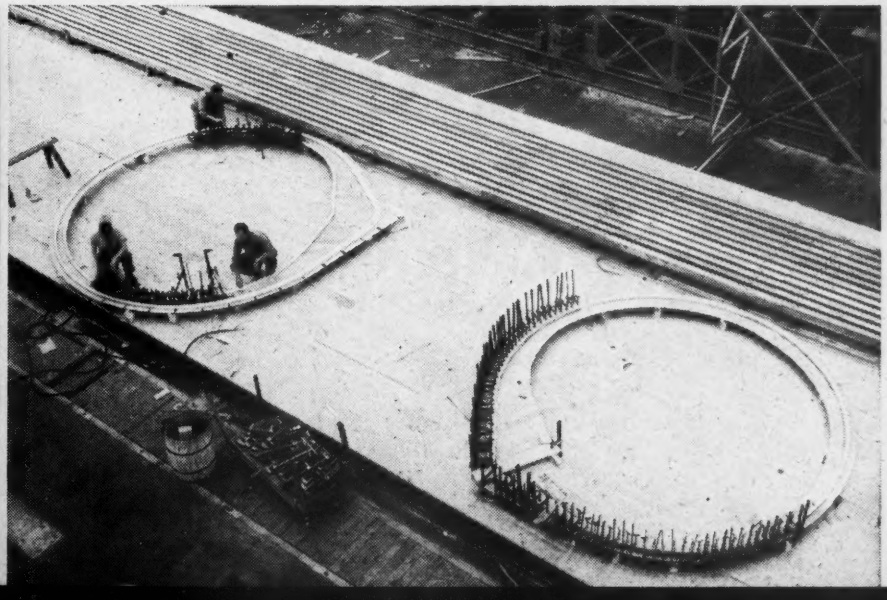
When the Hercules was first planned, in 1942, the contract was made with the Kaiser-Hughes Corporation, but this was dissolved in 1944, and the work is now handled entirely by the Hughes Aircraft Company. In designing the hull shape the N.A.C.A. engineers at Langley Field were consulted, and their vast experience resulted in a hull which, when tested in model form in the tank, was found to have good water performance. On the aerodynamic side also the N.A.C.A. was able to suggest extrapolation of available data to the high Reynolds Number involved in such a large aircraft.

Many problems were encountered in the construction, owing to the need for great accuracy in the thickness of the glue lines. Three different types of resin glues have been used: the plywood surfaces are bonded with a phenol-formaldehyde resin; laminated members such as spars, stringers and longerons are cemented with a urea-formaldehyde resin, and joints in the hull skin are made with resorcinol-formaldehyde resin

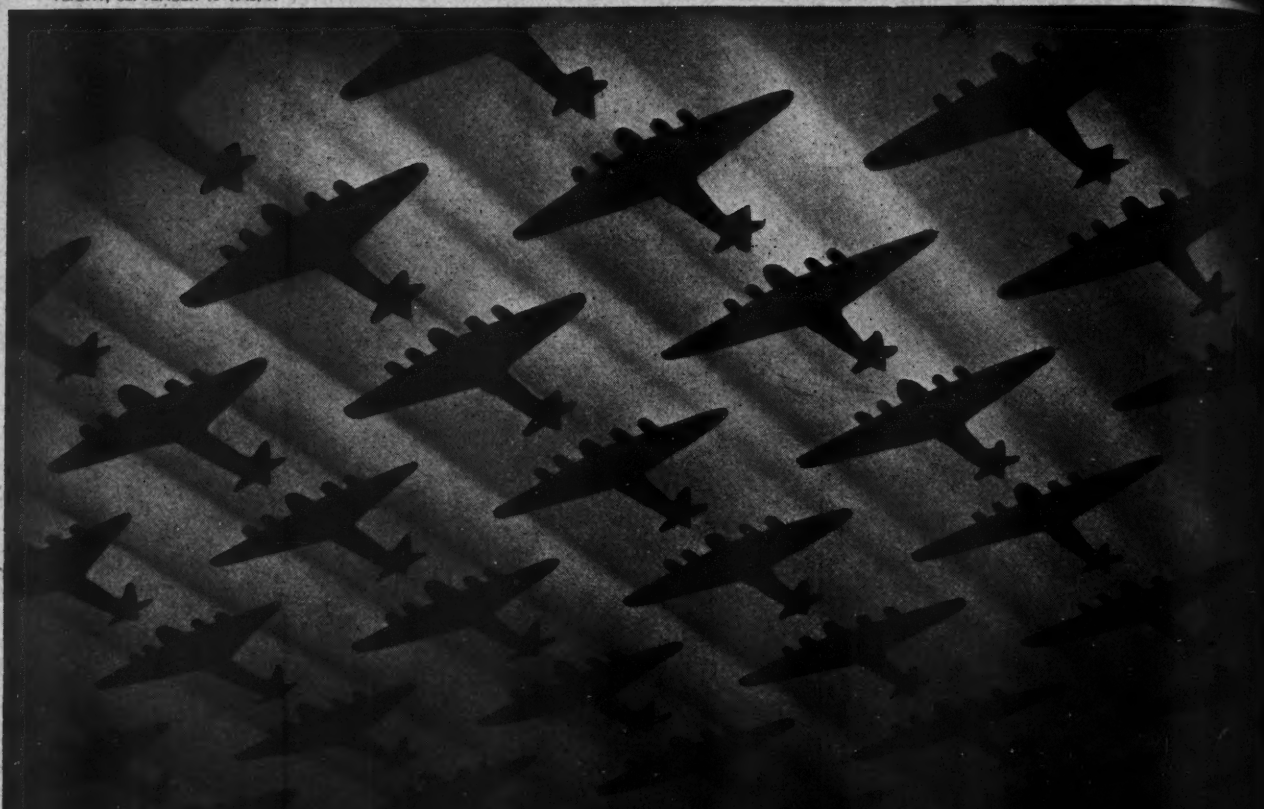
The following figures give some idea of the task undertaken by the designers. The wing span is 320ft., and the root thickness 13ft. The hull has a length of 220ft. and a depth of 30ft. Eight engines of 3,000 h.p. each provide the power and drive four-bladed airscrews of 17ft. 2in. diameter. The fuel capacity is 14,000 American gallons.



Initially designed to carry military equipment or troops, the Hercules can have a variety of internal layouts. The one shown, diagrammatically above represents 400 troops who, with their ammunition, weigh 110,000lb. Benches and other furnishings account for another 10,000 lb.



On the left, assembling hull frames. They are made entirely of birch, while the stringers are of composite birch and spruce construction.



Everything depends on Accuracy

SMITH'S
AIRCRAFT INSTRUMENTS

SMITHS

THE AVIATION DIVISION OF S. SMITH & SONS (ENGLAND) LTD.

The Decca Navigator

New and Revolutionary System for Instantaneous and Accurate Position Indication

THE announcement of the existence of the Decca Navigator, which, as its name implies, is produced by the famous gramophone and radio concern, heralds the opening of an entirely new age for the private owner-pilot. This is not to suggest that the device is suitable only for this class of work—on the contrary, it is, in fact, eminently suitable for navigation of any type of aircraft or, for that matter, any sort of ship.

There has, of late, been a great deal of publicity given to radar, and in last week's issue of *Flight* we published a review of the systems used by Bomber Command. Readers of that article will remember the system known as "Gee," and our only object in making reference here to that system is that the Decca Navigator has a certain similarity in operation to "Gee," but is purely a radio system; it is definitely not radar. What, perhaps, is extremely important is that, without any of the complication and special operation required by "Gee," or, if it comes to that, any radar system, the Decca Navigator is actually about five times more accurate, is much easier to use, and, moreover, can be operated very much more quickly.

Answer to the Private Pilot's Prayer

We feel that there can be little doubt that this new device will be hailed by the whole flying fraternity as a saviour, and although, as mentioned, it will undoubtedly be of paramount importance to the airliner, the freighter and the feeder-line type, it is probably with the private owner-pilot that this innovation will have its greatest impact. We state this advisedly because the average amateur pilot of pre-war days had only the most elementary knowledge of how to find his way about; he frequently got lost, and, although all this was great fun, it was rather outside the true realm of flying as such. By contrast, the post-war pilot whose aircraft is equipped with the Decca Navigator will, by relating the readings of two dials to a special chart, be able to determine the position of his aircraft with complete certainty. It is as simple as that.

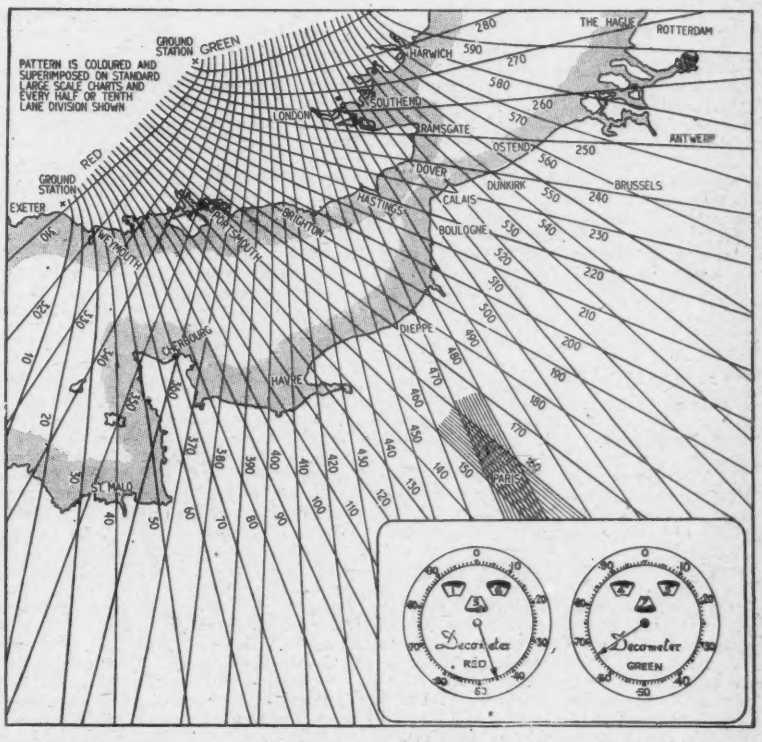
The aircraft installation has a total weight of 27 lb., although there is the possibility that this might be reduced, and the set can be stowed in the most convenient place anywhere in the machine. Readings are given on two three-inch dials, one figured in red, the other in green, the only controls being a zero-setting adjustment for each dial and an on-off switch. As may be seen from the accompanying diagram, the dials have windows in which appear hundred, ten and unit figures, and a needle pointer indicates against a peripheral scale for the decimal fraction part of the reference.

Ground stations in this country send out long-wave signals of constant strength which radiate along hyperbolic paths. For the sake of clarity, in the diagram only every tenth line is shown, as otherwise the spacing of the lines would be lost in the reproduction. However, in actuality each half-line will be shown on the aircraft charts, each main line of signal strength being consecutively numbered and printed in red for one station and green for the other. It is this fashion of superimposing the lines of signal strength on to the ordinary aviation map, and the fixing of the aircraft's position by means of signal intersections, that gives this device its apparent similarity to the radar "Gee" system.

Two Intersecting Lines Give the Fix

As an illustration of the use of the Navigator, reference should once more be made to the diagram. It will be seen that the left (red) dial is indicating 156.45, whilst the right (green) dial is indicating 473.66. Reference to the signal lines will show that the intersection of green 473.66 and red 156.45 gives a fix some few miles north by west of Paris.

Range is at present up to about 1,500 miles, but the optimum range is about 300 miles, the accuracy of fix at this distance being about 100 yards. Consequently, a chain of stations covering the Continent and spaced 600 miles apart would allow a minimum fix accuracy comparable to the best obtainable by other means. Again, for trans-atlantic flights, the stations in this country will handle the eastern 1,500 miles and the American station the western; thus the position of an aircraft could be determined instantaneously throughout a flight. The advent of this instrument renders obsolete the very complicated and highly critical mechanical computers such as the present



A small-scale typical chart on which only every ten signal paths are shown. Readings on the dials give a fix, as shown, above Paris. On actual charts every signal line is shown.

THE DECCA NAVIGATOR

air mileage unit, air position indicator and ground position indicator.

We will assume that the private owner of a light machine is going to fly a distance of 150 miles. Prior to the flight he has a look at his special chart, and, knowing the signal numbers of his home airport, notes on a card the signal numbers of his destination and also the values at, say, six intersections on the route. He has thus virtually planned his flight in advance, and can climb into his machine and fly along the chosen course according to the intersections on the card being registered on the decometer dials until, when the final readings appear, he will know that he is then directly over his required destination.

Alternatively, if his route happens to coincide near enough with one of the signal paths, he can take off and fly along that path by keeping its number showing on the appropriate dial, thus literally flying "on the beam."

The great thing about this device is that anyone can use it after five minutes' explanation; it is completely self-contained, needs no special aerial equipment and does not require maintenance. The manufacturers, however, suggest rather than recommend that routine checking should be made about once every three months. Nevertheless, even this would seem scarcely to be necessary, for every time the set is switched on and the dials are set for a known reference position, it is of necessity self-checking.

The normal aircraft set operates on 80 watts, which, for the standard aircraft 24-volt system, represents a current consumption of 3.3 amps. However, where required for light aircraft, a battery set will be available.

R.A.F. STATIONS OPEN ON SATURDAY NEXT

Public Invited to Visit Service Airfields on Battle of Britain Anniversary

FOR the first time in six years a number of stations and airfields of the Royal Air Force in many parts of the country are to be open to the public. This R.A.F. "at home" will commemorate the Battle of Britain anniversary on Saturday, September 15th.

The stations to be open include those of all commands of the R.A.F.: Fighter, Bomber, Coastal. Transport, Technical Training and Maintenance. It has, unfortunately, not been possible to include many of the stations in South-East England directly identified with the Battle of Britain as they are no longer operational.

The list below shows stations to which the public will be admitted and the commands to which the stations belong.

The stations will be open to the public from 2.30 p.m. to 6 p.m., but visitors will not be admitted with cameras.

England

London: Hendon (Transport); *Bedfordshire:* Wing (Bomber), Cardington (Tech. Trg.) and Henlow (Maintenance); *Norfolk:* Methwood (Bomber), Foulsham (Bomber) and Bircham Newton (Coastal); *Suffolk:* Mildenhall (Bomber) and Felixstowe (Coastal and Maintenance); *Huntingdon:* Wyton (Bomber) and Upwood (Bomber); *Hampshire:* Thorney Island (Coastal), Calshot (Coastal), Chilbolton (Fighter), Stoney Cross (Transport), Holmsley South (Transport), Odiham (Transport), Romsey (Maintenance), Andover (Fighter); *Oxford:* Upper Heyford (Bomber), Brize Norton (Flying Trg.) and Chipping Warden (Flying Trg.); *Berkshire:* Abingdon (Bomber) and Welford (Transport); *Bucks:* Halton (Tech. Trg); *Wiltshire:* Upavon (Flying Trg), Hullavington (Flying Trg.) and Netheravon (Transport); *Gloucestershire:* South Cerney (Flying Trg.), Little Rissington (Flying Trg.) and Filton (Transport); *Somerset:* Locking (Tech. Trg.), Weston Zoyland (Fighter); Charmy Down (Flying Trg.) and Lulsgate Bottom (Flying Trg); *Cornwall:* St. Eval (Coastal) and Predannack (Fighter); *Devon:* Chivenor (Coastal); *Worcester:* Halfpenny Green (Flying Trg.); *Warwick:* Castle Bromwich (Fighter), Wellesbourne Mountford (Flying Trg.), Church Lawford (Flying Trg.) and Bramcote (Transport); *Shropshire:* Ternhill (Flying Trg.), Shawbury Flying Trg.) and Tilstock (Transport); *Hereford:* Hereford (Tech. Trg); *Staffordshire:* Cosford (Tech. Trg.) and Stafford (Maintenance); *Northamptonshire:* Silverstone (Bomber), Turweston (Bomber) and Peterborough (Flying Trg.); *Rutland:* North Luffenham (Bomber); *Lincolnshire:* Scampton (Bomber), Hemswell (Bomber), Grantham (Tech. Trg.), Manby (Tech. Trg.) and Swinderby (Bomber); *Leicester:* Wymeswold (Transport); *Notts:* Newton (Flying Trg.) and Ossington (Transport); *Yorkshire:* Leeming (Bomber), Finningley (Bomber), Church Fenton (Fighter), Driffield (Transport) and Holme (Transport); *Durham:* Thornaby (Coastal) and Middleton St. George (Fighter); *Northumberland:* Acklington (Fighter); *Cumberland:* Crosby-on-Eden (Transport); *Cheshire:* Sealand (Maintenance); *Lancashire:* Kirkham (Tech. Trg.), Weeton (Tech. Trg.), Wilmslow (Tech. Trg.), Barrow (Flying Trg.), Cark (Flying Trg.) and Ringway (Transport).

Scotland

Fife: Leuchars (Coastal); *Inverness-shire:* Inverness (Fighter), Dalcross (Flying Trg.); *Midlothian:* Turnhouse (Fighter); *Caithness:* Wick (Fighter); *Wigtownshire:* Wigtown (Flying Trg.); *Ayrshire:* Prestwick (Transport).

Wales

Pembroke: Pembroke Dock (Coastal), *Glamorgan:* St. Athan (Tech. Trg.) and Fairwood Common (Fighter); *Merioneth:* Llanbedr (Fighter); *Cardiganshire:* Aberporth (Fighter); *Anglesey:* Valley (Transport).

County Antrim (Northern Ireland): Aldergrove (Coastal).

Isle of Man: Andreas (Flying Trg.) and Jurby (Flying Trg.).

ALBERT HALL PAGEANT

READERS are reminded that on Wednesday and Thursday of next week some 2,000 men and women of the R.A.F., the W.A.A.F. and the Dominion Air Forces are taking part in a pageant at the Albert Hall which will depict the progress of flying and some aspects of the work done by the air weapon in the war. The cost is borne entirely by *The Daily Telegraph* and the proceeds will go to the R.A.F. Benevolent Fund and the R.A.F. Association. Tickets can be obtained from the box office of the Royal Albert Hall, the prices ranging from £1 1s. to £3 3s.

A "PRE-WAR" MEETING

A HAPPY little meeting was held on September 1st at Rearsby airfield, Leicester, by the Leicestershire Gliding Club, with which Taylorcraft Aeroplanes, Ltd., collaborated, to make the whole affair redolent of those days we knew over six years ago.

Naturally enough, gliding was the principal feature of the meeting, the A.T.C. Midland Command being represented in some force, and, in spite of the somewhat shabby treatment meted out to the A.T.C., probably the keenest of the Services' training fields, it was both reassuring and enlightening to see the patent keenness and whole-heartedness which these lads have in their "Service."

Prince Birabongse of Siam, most widely known as "B. Bira," the successful driver of racing cars, gave some very pretty flights in "Minimoa" the ex-Phillip Wills sailplane, and also flew the Gull III Slingsby sailplane. Weather conditions were, unfortunately, not as good as they might have been, so that soaring was not practicable; however, the various flights by the high-efficiency sailplanes and the primary and advanced training gliders were sharply contrasted by the power flight exhibitions of an Auster aircraft in the hands of Geoffrey Edwards, Taylorcraft's chief test pilot, and some extraordinary manœuvres in a Harvard flown by Peter Clifford, chief test pilot to Helliwells, Ltd.

These the crowd fairly lapped up, and certainly it would be difficult to find an aircraft more violently contrasting to the silent, gentle flight of a glider than a Harvard. The incredible agility of the Auster, its relative quickness for its power, and the ridiculously small compass in which it can be set down, all these were admirably shown. Altogether, the Rearsby meeting was a pleasant, lively affair which, we hope, will quickly be followed by many others throughout the country.

Deflex-Reaction Propulsion

Some Theoretical Considerations of an Unorthodox Method of Increasing Jet Efficiency

By F. UMPLEBY

ACCORDING to Newton's Third Law, action and reaction are equal and opposite, but before we can utilise reaction to propel an aircraft we must have some abutment upon which the reaction can take effect. In a piston engine the reaction of the explosion takes effect upon the cylinder head, and the active working forces are transmitted through the piston and connecting rod to the crank pin and thence to the main bearings. The constraint of these reactive and working forces tends to lift the cylinder head from the engine structure. In reaction propulsion the unconstrained forces are free to take effect upon a number of fixed abutment points from which they are transmitted to the body of the propulsion machine and thence to the aircraft in which it is installed.

THE following article is of a controversial nature, and not everyone will accept the author's deflection theory which, to many, will appear reminiscent of a man trying to lift himself by his boot straps. We shall welcome the opinions of readers as the subject needs to be thoroughly discussed in view of the great increases in efficiency claimed by the author.

The reactive force generated is due to the increase in momentum imparted to the fluid gas stream by thermal and mechanical operations as it passes through the machine. A simple case is that in which an axial-flow air compressor is driven by an axial-flow turbine, with simple axial combustion between the two. The fluid medium is driven through the machine axially from the inlet to the discharge outlet. Reaction is also obtained when a fluid gas stream is deflected around a bend, or in the blades of a turbine, and both increases in momentum and bend deflection reaction can be utilised to provide propulsive forces, *i.e.* the propulsion machine as a whole may operate on the impulse-reaction principle.

Axial and Bend Reactions

Each of these actions can be seen at work in a river. For example, where a change in the section of the river bed occurs, a hydraulic jump is created from which a wave may often be seen travelling up stream against the current. This may be said to illustrate axial fluid reaction. Where the stream sweeps around a bend, the outer bank is washed away, which illustrates the effect of bend reaction upon the river bank.

In the case of purely axial flow, the momentum of the gas stream in relation to the acceleration of the fluid is decreased by an amount equivalent to the velocity of flight. As the velocity of flight increases, the effective propulsion force decreases, except in so far as the ram effect increases the density and mass flow of the air entering the air compressor. On the other hand, in the case of bend deflection or impulse-reaction, the whole of the fluid gas stream and the abutment elements upon which it reacts move as one body, and the resultant effective propulsion force is constant at all flight speeds, and is enhanced by the ram effect.

In considering these forces in detail the following simple formulæ will be used, and one pound of air per second will be taken as the basic quantity consumed.

$$\text{Static Axial Thrust } T = \frac{W(V - V_1)}{g} \quad .. \quad .. \quad .. \quad (1)$$

$$\text{Static Resultant Bend Reaction Force } R = \frac{W}{g} \quad (V_2 \cos a) + (V_3 \cos b) \quad .. \quad .. \quad .. \quad (2)$$

$$\text{Static Thrust component } T = R \sin c \quad .. \quad .. \quad .. \quad .. \quad (3)$$

$$\text{Axial Thrust in Flight } R \text{ or } T = \frac{(W + w)(V - v)}{g} \quad .. \quad .. \quad (4)$$

Axial Thrust in Flight, for sloping pipe, from 4, $T = R \cos c$ (5)

Reaction Bend Thrust in Flight, R found from 2, $T = R \sin cw$ (6)

Where T = Thrust, pounds.
R = Resultant of velocity forces.
W = Weight of gases, pounds per second.
w = Weight of gases, pounds per second, added due to ram effect.
V = Velocity of gases, feet per second.
$V - V_1$ = Difference in gas velocity, *i.e.* change in momentum.
V_2 = Velocity of gases entering bend, feet per second.
V_3 = Velocity of gases leaving bend, feet per second.
v = Velocity of flight, feet per second.
a = Angle through which entering gases are deflected.
b = Angle through which leaving gases are deflected.
c = Component angle of resultant thrust force.
g = 32·2.
$\frac{W}{g}$ for air = ·03105.
$\frac{W}{g}$ for combustion products = ·0316.

The actions and reactions of the gases may be illustrated by means of simple velocity or force diagrams in which the line of action is shown by an arrow and the intensity of the action is indicated by the length of the arrow, to scale. The double-headed arrows indicate the direction of flight in all cases.

Fig. 1 shows the simple axial flow in which action and reaction are indicated by arrows pointing in opposite directions and the propulsive force generated is obtained from formula (1).

Fig. 2 shows the case where a simple 45 deg. bend is

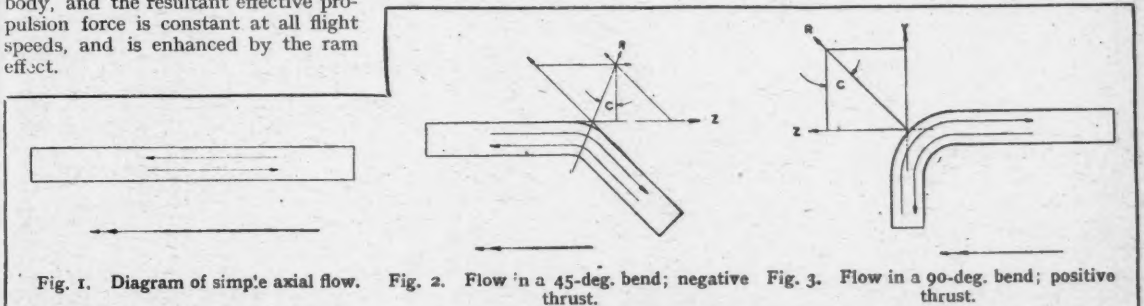


Fig. 1. Diagram of simple axial flow. Fig. 2. Flow in a 45-deg. bend; negative thrust. Fig. 3. Flow in a 90-deg. bend; positive thrust.

DEFLEX-REACTION PROPULSION

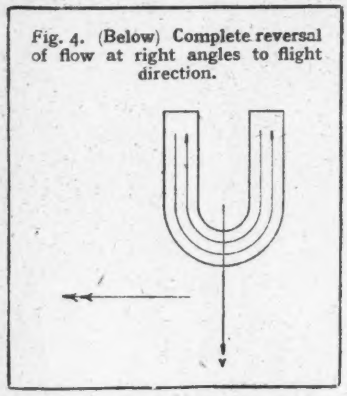


Fig. 4. (Below) Complete reversal of flow at right angles to flight direction.

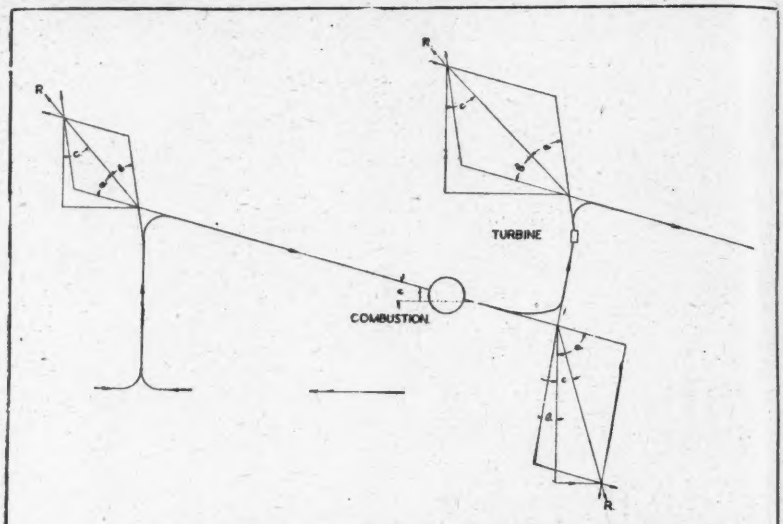


Fig. 5. Flow path through jet propulsion unit; double-entry radial compressor and radial turbine.

introduced in the circuit, and it will be noted from the superimposed force diagram that the reactive propulsion force generated is negative, *i.e.* it acts as drag, from formulæ (*2*) and (*3*).

Fig. 3 shows the case for a 90 deg. bend, and it will be observed from the force diagram and the reversed position of the bend in relation to the direction of flight, that a positive propulsive force is generated, from formulæ (*2*) and (*3*). The reaction stresses indicated by arrow Y in the force diagram have no propulsive effect and are taken care of in the structure of the machine. The value of the resultant reaction force depends upon the velocity of the gas stream and the sine of the angle *c*.

Fig. 4 shows a complete reversal in the flow of the gas stream. In this case no propulsive force or drag is generated by the flowing gas stream and the resultant stress, indicated by arrow Y, is again opposed by the structure of the machine. In this case, however, the force indicated by arrow Y is double the similar force created in the 90 deg. bend.

Flow Path through Machine

These elements can now be combined into an example which will be illustrative of practical designs which are to follow. Fig. 5 indicates the complete flow path of the gas stream through the machine, together with the reactions engendered. The air enters a double-sided centrifugal air compressor and is turned through 90 deg. to emerge radially. Thus no thrust forces are created at the compressor entry, since the deflection reactions balance each other. On leaving the compressor the air is turned through 115 deg. in a rearward direction, and a forwardly acting reaction force is thus created; the air velocity at this point is assumed to be 200 feet per second.

Subsequently, the air passes through the combustion system, where its velocity is increased to an assumed figure of 1,000 feet per second. Its thermal energy content is increased, as well as its mass, by the addition of fuel. On emerging from the combustion system the gas stream is turned outwardly through 85 deg. and its velocity is increased in the bend to 2,000 feet per second, accompanied by a corresponding decrease in its energy content.

It will be noticed that this bend is similar to the bend shown on Fig. 4, and that its effect on the thrust is but slight. The gases are now, however, flowing radially in the direction required to drive the radial-flow turbine, which in turn drives the air compressor. The gases finally emerge from the periphery of the turbine at about 1,400 feet per second and are immediately turned rearwardly through an angle of about 116 deg. In the bend the gas velocity is increased to 1,620 feet per second, and it is from this final bend deflection that the greater part, almost the whole, of the effective forwardly-acting thrust is obtained.

Having now discussed the reactions which occur at the respective bends, it remains to investigate them individually and collectively from a detailed thrust point of view, basing all our calculations on standard sea level atmospheric conditions. Commencing at the outlet of the air compressor, the positive static thrust generated at the 65 deg. bend is given by :—

$$R = \frac{W}{g}(V_2 \cos a) + (V_3 \cos b)$$
$$= \frac{W}{g}(V_2 \cos 32\tfrac{1}{2}\text{ deg.}) + (V_3 \cos 32\tfrac{1}{2}\text{ deg.})$$
$$= \frac{W}{g}(200 \times \cdot 8434) + (200 \times \cdot 8434)$$
$$= \frac{W}{g}(168{\cdot}68 + 168{\cdot}68)$$
$$= \cdot 03105 \times 337{\cdot}36$$
$$= 10{\cdot}5 \text{ lb.}$$

and the thrust component will be :—

$$T = R \sin c$$
$$= R \sin 49 \text{ deg.}$$
$$= 10{\cdot}5 \times \cdot 7547$$
$$= 7{\cdot}7 \text{ lb.}$$

The combustion system and its pipework is inclined at 15 deg. to the horizontal line of level flight. Injecting ·018 lb. of fuel per pound of air per second into the combustion system, the velocity of the gases is increased from 200 to 1,000 feet per second, and the increase in momentum will be 1,000–200 = 800 feet per second. The resultant propulsion force generated will be :—

$$R = \frac{W(V - V_1)}{g}$$
$$= \frac{W}{g} \times 800 = \cdot 0316 \times 800$$
$$= 25{\cdot}28 \text{ lb.}$$

and the resultant thrust component will be :—

$$T = R \cos c$$
$$= R \cos 15 \text{ deg.}$$
$$= 25{\cdot}28 \times \cdot 9659.$$
$$= 24{\cdot}4 \text{ lb.}$$

The negative thrust at the 85 deg. bend will be :—

$$R = \frac{W}{g}(V_2 \cos a) + (V_3 \cos b)$$

DEFLEX-REACTION PROPULSION

$$= \frac{W}{g} (V_2 \cos 75 \text{ deg.}) + (V_3 \cos 10 \text{ deg.})$$
$$= \frac{W}{g} (1000 \times \cdot 2588) + (2000 \times \cdot 9848)$$
$$= \frac{W}{g} (258.8 + 1969.6)$$
$$= \cdot 0316 \times 2228.4$$
$$= 70.4 \text{ lb.}$$

and the resultant thrust component will be :—

$$T = R \sin c$$
$$= R \sin 16\tfrac{1}{2} \text{ deg.}$$
$$= 70.4 \times \cdot 284$$
$$= 20 \text{ lb.}$$

The positive thrust at the final bend will be :—

$$R = \frac{W}{g} (V_2 \cos a) + (V_3 \cos b)$$
$$= \frac{W}{g} (V_2 \cos 35 \text{ deg.}) + (V_3 \cos 29 \text{ deg.})$$
$$= \frac{W}{g} (1400 \times \cdot 819) + (1620 \times \cdot 8746)$$
$$= \frac{W}{g} (1146.6 + 1416.8)$$
$$= \cdot 0316 \times 2563$$
$$= 81 \text{ lb.}$$

and the resultant thrust component will be :—

$$T = R \sin c$$
$$= R \sin 45 \text{ deg.}$$
$$= 81 \times \cdot 707$$
$$= 57.27 \text{ lb. per pound of air per second.}$$

The sum of the combined bend and axial mass-flow thrusts will be $57.27+7.7+24.4-20=69.37$ lb. Of this, 44.97 lb. thrust, due to bends, will be constant and independent of flight speeds, while 24.4 lb. thrust, due to increased mass-flow momentum, will decrease as the speed of flight increases.

Thrust Variations During Flight

The effects of these variations in thrust during flight are given in Fig. 6, which covers an aircraft speed-range from zero to 650 m.p.h. at sea level. In plotting all these curves, the increase in density and mass flow due to ram effect has been taken into account, and all are based on 100 per cent. efficiency, whereas, due to gas friction and eddy losses, the actual efficiency attained will be of the order of 88 per cent.

From these curves a number of the more promising features of this system of deflection propulsion will be apparent. Using the purely axial flow system as the basis for comparison, the fuel consumption per pound of thrust engendered, per pound of air per second, should be reduced by something of the order of 28 per cent. at take-off speed and 63 per cent. at 400 m.p.h. Similarly, the thrust available for take-off will be increased by about 28 per cent. and at 400 m.p.h. by about 63 per cent. The thrust available for climb will be increased by about 37 per cent.

Thus, although as components the axial compressor and the axial turbine are relatively more efficient than the centrifugal compressor and the radial turbine, it does not necessarily follow that they are the most efficient combination for aircraft propulsion. Furthermore, from curve A it will be apparent that the thrust is reasonably constant up to 300 m.p.h. With the deflection propulsion plant operating at its point of maximum performance over this speed range, and at the same time maintaining thrust independently of the variations in flight speed, the calculations suggest that it would be possible to operate successfully commercial and private aircraft of the lighter types on non-volatile fuels.

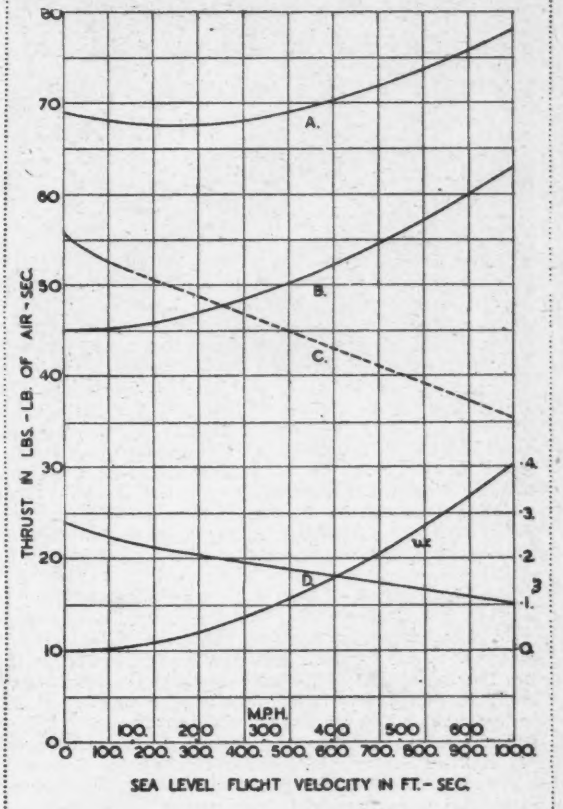


Fig. 6. Curve showing variation of thrust in relation to flight velocity. A = combined bend-deflection and mass-flow thrust. B = thrust due to deflection alone. C = thrust due to axial end-to-end mass flow. D = thrust due to mass-flow component. W = increase in density due to ram effect.

ULSTER WINS AT MODEL CONTEST

THE Ulster Model Aircraft Club won the principal honours at the fifth national model aircraft flying contest held recently at the Dublin Airport (Collinstown). The National Agricultural and Industrial Development Association Trophy for the best average time in the Wakefield Class (rubber-driven) went to B. Crawford (Ulster) with an average of 71.06 secs.; T. Daulman (Ulster) was second, and J. Archbold (Dublin Model Flying Club) third.

First prize in the petrol-driven class went to Dr. H. Charles (Dublin) with a total time of 190.4 secs.; J. Archbold (Dublin) and J. P. Evans (Dublin) were second and third.

The inter-club team event was won by the Ulster Club with an aggregate flying time of 511 secs.; Belfast Flying Club (345.3 secs.) was second, and the Dublin Club (260.9 secs.) third. The award for the best individual flight went to R. Galway (Ulster).

Over a thousand spectators watched the contests.

NEW COASTAL COMMAND GROUP

THE Air Ministry announces that No. 15 Group Coastal Command and R.A.F., Northern Ireland, have been amalgamated into one group in Coastal Command to be called R.A.F., Northern Ireland.

R.A.F., Northern Ireland, will be commanded by Air Commodore A. R. Churchman. Air Marshal Sir Leonard Slatter, who was A.O.C. No. 15 Group, from early 1943 until June of this year, is now A.O.C.-in-C. Coastal Command.

Keeping Watch on Jerry

How the Photo. Recce. Squadrons Went to Work : Secrets of Medmenham's Cellars : Aircraft and Equipment

By N D. RYDER

IT was in 1938 that General Von Fritsch, chief of the German General Staff at the outbreak of war, said, "The military organisation with the most efficient photographic reconnaissance will win the next war."

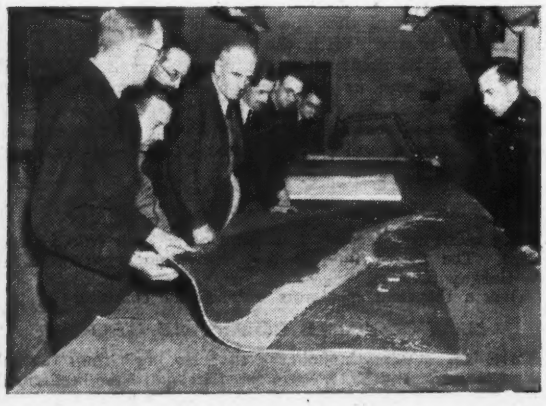
Von Fritsch may well have foreseen the coming war with Britain and the U.S. when he made that shrewd observation, but it is hardly likely that he expected it would be the Allies who would prove him right. Yet the Spitfires and Mosquitoes of the P.R.U. at Benson, near Oxford, backed by the skill of the processers and that of the interpreters of the Allied Central Interpretation Unit at Medmenham nearby, did just that.

Not that we started the war as the side with the most efficient P.R. organisation. On the contrary, with typical British unpreparedness, we began with virtually no P.R. at all!

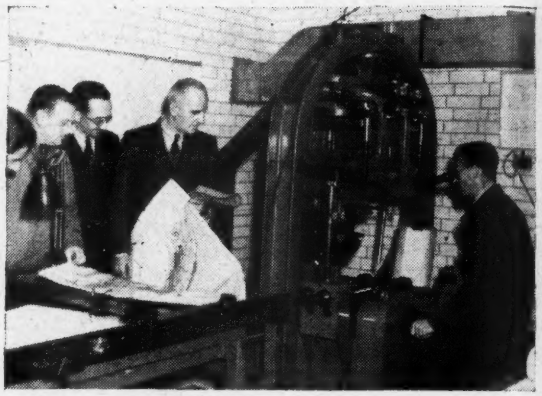
There had, of course, been "photo recce" in the 1914-18 war but it had been a mere sideline carried out by converted bombers which trundled out a few miles over the enemy lines and, if not escorted, were cold meat for the first Hun scout that happened along. At the start of this war P.R. duties were farmed out to such leisurely things as Lysanders which were relatively no better off than the "Harry Tates" of the 1914-18 era. In the grimly apt jargon of the Service, there was no future in it.

Then it occurred to somebody that what was wanted was an aircraft which could fly high enough and fast enough to keep out of danger. The Spitfire and, later, the Mosquito, provided the answer.

In September, 1943, *Flight* visited the P.R.U. at Benson and was permitted to describe, in very general terms, the growth of this branch of the Service and something of the work being done. But little or nothing could be said at that time about the *modus operandi*, and not very much about the "Spits" and "Mossies" being used beyond the somewhat obvious fact that they carried cameras of a type already familiar. The really big secret, however, was the



NOT FOR RUBBERNECKS : This model of a section of the Normandy beach, made in synthetic rubber and based on air photographs, was one of the briefing models for D-Day—another of Medmenham's secrets.



THE SAUSAGE MACHINE, as it is called by its operator, produces maps from photographs by just turning a handle. Last week it was "revealed" for the first time at Medmenham.

A.C.I.U. at Medmenham, just over the county border in Buckinghamshire. To paraphrase a familiar "no smoking" notice, the order here was "No visitors; not even *Flight*."

Gleaning full and accurate information from the photographs is patently just as important as the taking of them and demands a high degree of specialised skill. But the large country house at Medmenham (built only some 40 odd years ago by the manufacturer of a famous brand of sauce!) contained more than skilled interpreters. It housed, for example, a library of photographic prints, any one of which is quickly available for reference, which has been steadily mounting in volume until it now totals some 7,000,000. Then there is the section where lifelike models of high-priority targets such as Kiel, Hamburg and the D-Day beaches, were made in synthetic rubber, and, down in its extensive cellars, vital maps of enemy territory were prepared. Incidentally there is in this section a machine which accurately reproduced a map from air photographs by merely turning a handle.

"Underground Activity"

Somehow these cellars and their once secret contents still breathe an almost unreal atmosphere, as of a film romance of the Secret Service; the "powerful international gang" of the fictional thriller might have its "secret headquarters" in just such a place. But in actuality these cellars were mostly the scene of long hours of patient effort, as when new briefing maps of some enemy objective were wanted in a hurry and it was a non-stop race against the clock.

Still, there sometimes was excitement at Medmenham, but we will come back to that later; let us for the moment return to Benson.

The routine here fell into five phases: receiving requests for coverage and settling priority, flying the sorties, processing the films and prints, first interpretation, and the distribution of reports and pictures. Phase (1) was handled by the Joint Photographic Reconnaissance Committee (J.P.R.C.), made up of a Naval Commander, an Army Colonel, an R.A.F. Group Captain, and a U.S. Colonel, all of whom took it in turns to act as chairman. This compact committee was, in effect, a sub-committee of the Joint Intelligence Committee. It handled all requests from our own services and from the U.S.A.A.F. The fact that they sat for the sake of convenience at Benson R.A.F. station did not give the Air Ministry any sort of advantage when it came to deciding priorities.

KEEPING WATCH ON JERRY

Two squadrons of Mosquitoes and two of Spitfires carried out the sorties and, in addition, P.R. aircrews were trained here for overseas units operating beyond the European theatre. Precisely what happened when the aircraft returned from its sortie would depend on the urgency of the job. If necessary, a D.R. would dash out to collect the exposed films from the aircraft, rush them to the processing section where a first-phase interpretation would be made from the developed negative the moment it emerged, and a preliminary report 'phoned instantly to the "customer." A more detailed interpretation from the prints would follow.

During the course of the war the character of the work performed by the P.R.U. naturally changed. Just after Dunkirk, when the unit was still a small but thriving infant, its chief concern was German invasion barges across the Channel. When the bombing offensive got under way it provided vital briefing material, followed by "after-treatment" pictures for damage assessment. Then came the preparations for D-day when shutters clicked over beach defences, gun emplacements and dropping sites for the airborne parties. As the Allies began their advance towards the Rhine and Berlin the enemy's railways and troop movements were No. 1 priority. And butting into all this was the grim business of the V1 and V2 sites. All but one of the total of some 230 of the former were ferreted out by the penetrating lenses of the P.R.U.

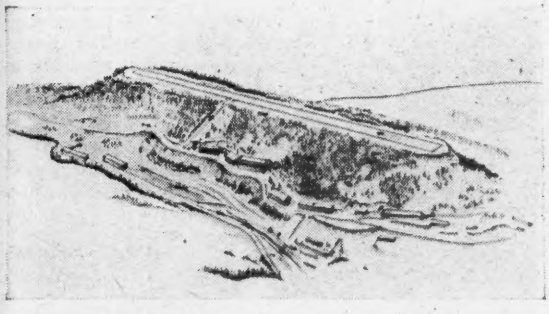
The story of the steady development of the P.R.U. from the day in 1939 when the first two Spitfires were fitted with cameras and extra fuel tanks and one of them covered Aachen, would alone fill one issue of *Flight*. It is a story of overcoming snags and steadily improving the equipment.

But only was the story one of better and better equipment, and long and longer flights; above all it was a battle for speed.

The latest version of the Griffon-engined Spitfire XIX is, says its enthusiastic pilots, the fastest conventional aircraft in the world, with a top speed of at least 460 m.p.h., a pressure cabin, a ceiling of over 43,000ft. and a range of 1,500 miles.

But the Spitfire XI was really the mainstay of P.R.U. With slipper tank as well as the leading-edge tanks, it has a range of 2,000 miles, and carries one 14in. oblique camera and two 8in. split cameras. Several Marks of Mosquito are now in use, including the Mark 34 with Merlin 113 and 114 engines. Various combinations of cameras are carried, but all are really developments of the F.24 and F.52 basic types. One of the latest 8in. cameras fitted vertically behind the belly tank of the Mosquito 34 gives a coverage of about 80 square miles at 30,000ft.

There is at Benson, needless to say, an instrument section where not only are the cameras kept in first-class order but much development work takes place. One particularly interesting line is with the moving film equipment designed to ensure dead sharp results at high speed and low altitude. Again, a whole book could be written on this subject alone.



The perspective sketch of the Me 262 underground plant with "roof-top" airstrip at Kahla, prepared after study of the photograph above.

FLAT-TOP ASHORE: The P.R. photograph of the queer airstrip at Kahla, on top of a hill. A.C.I.U. experts found that inside the hill was an aircraft factory which, it transpired, was producing Me 262 jet-propelled fighters.

Mention has already been made of exciting moments at Medmenham, and two instances are worth recording. One was the discovery of a V1 site which had been most cunningly merged into a quite harmless-looking built-up area. Suspicions were at first aroused when a photograph disclosed one little building which was slightly out of line with the others. It had long been known that on every V1 site there was a building lined up with the launching ramp so that gyroscopes and compasses could be set for the direct course to London. A quick check on the map showed that this out-of-line building was set towards London; another V1 site had been discovered, but it was not until a faulty doodlebug removed the roofs of some adjacent houses and blew up the conduit below which the ramp had been placed that the full details of its crafty disposition became evident.

Smart Detective Work

The other story concerns the discovery of the big synthetic oil plant at Brux. The first clue came when one of the Medmenham experts, scrutinising a German newspaper obtained through our Intelligence, spotted an advertisement for an engineer with certain special qualifications who was wanted for work at this town. The qualifications mentioned suggested work of a type that might be connected with building an oil plant. The hint was enough. A P.R.U. pilot set forth and, sure enough, brought back pictures showing such a plant in the early course of construction. Needless to say, it earned a high priority on Bomber Command's programme.

Then there was the discovery of the Me 262 factory buried in a hill at Kahla, near the Czech border, the summit of which had been levelled to form an airstrip. The aircraft were hauled up to this "deck" up a steep ramp through the tree-clad hillside.

And so P.R.U. steadily uncovered almost every single activity of the enemy while he, of course, was denied any comparable knowledge of what we had in store for him.

To-day there is an aspect of the P.R.U. which puts it in rather a different category from any other operational branch of the R.A.F.; its work has not finished with the end of hostilities. It is, for example, busy locating mines at sea and on the home beaches. In peacetime, too, there are a number of applications of air photography in which the P.R. squadrons will be engaged. Already, in fact, they are at work on air survey for the Ministry of Town and Country Planning, while agriculture can also make use of air photography in connection with crops and forestry.

CIVIL AVIATION

Iceland Airways

Modest Beginning : Operational Conditions : Future Prospects

D.H. Dragon Rapides and a Beechcraft serve Iceland's scattered communities.

ICELAND is not entirely an arctic country as its name might imply. Its northern headlands scarcely reach the Arctic Circle and it takes some warmth from the Gulf Stream, but it is a rugged and mountainous island with scattered, hard-living communities and extreme difficulties to all surface transport. The few roads are tortuous and often made impassable by winter snowdrifts.

Larger than Ireland, Iceland has 130,000 inhabitants, of whom nearly 50,000 live in the vicinity of Reykjavik, the capital in the south-west, and the remainder are spread over the coastal farming areas and fishing centres. The central part of the country comprises a mountainous region rising to about 7,000ft., streaked with canyons and glaciers.

In addition to agriculture, which concentrates in the fertile hinterland of the south, fishing and its attendant industries are the chief occupation of the Icelanders. In northern Iceland, where pack ice from the Polar Sea reaches in winter to within 20 or 30 miles off the shore, fishing activity concentrates in the summer months, while cod fishing off the southern shores is in full season in winter.

Such seasonal occupation results in quite a sizable shift of population, which occurs in the spring, notably to the fish industries around Akureyri, Siglufjordur and other northern ports.

Where small and scattered communities wrest a frugal livelihood from primary occupations, air transport can render appreciable service to raise the general standards of life. But to do so effectively, it must be conducted on simple if efficient lines, for no elaborate organisation could be supported at the prevailing price levels.

It is with this objective in view that Iceland Airways, Ltd. (*Flugfelag Islands, H.F.*) were formed in 1937, and started operations in May, 1938, with one Waco "S" cabin seaplane. Some useful work was done until this aircraft capsized at moorings in a gale in February, 1940. The company was then reorganised, the office and base moved to Reykjavik, the Waco rebuilt as a landplane, and another Waco "ZKS" on floats purchased for coastal work.

Equipment

In 1942 an eight-passenger Beechcraft 18D powered with two 330 h.p. Jacobs engines was acquired and the traffic was steadily increasing. By 1944 it was necessary to enlarge further the company's fleet. Two Dragon Rapides, one for 6-7 and the other for 5-6 passengers, and later in 1944 a Consolidated P.B.Y.-5 Catalina were acquired. The flying boat was converted in the workshops of Iceland Airways to carry 22 passengers for serving coastal towns without landing facilities and with an eye to possible future international operations.

The main scope for regular operation of Iceland Airways is the route between Reykjavik and Akureyri, 160 miles direct, or 180 to 200 miles skirting the glaciers and lava fields of the interior. The trip is made in about 1½ hours as compared with a 12 hours' journey by motor bus in summer-time along difficult roads which are closed for most of the winter. Akureyri has a population of about 7,000, but serves a cattle and sheep-rearing region of several thousands more on the northern slopes.

There are other market centres equally cut off. Egilsstadir in the east is a small town serving some 10,000 people engaged in farming, but has no road connections with the rest of the island. Hofn in the south-west, 240 miles from Reykjavik, is similarly isolated and serves a farming and fishing community. Some 4,000 people inhabit one of the Vestman Islands, 8 or 10 miles off the south coast, where there is a fishing centre with the accompanying fish-oil industries.

Diversity of Operations

A fuel load sufficient for a return journey is neatly always carried, one reason being the difficulty of transporting petrol to the out-base and another the danger of unexpected weather changes. On the Beechcraft carrying eight passengers there is still sufficient load capacity to permit of full tankage, giving 4 hours' endurance at about 165 m.p.h. On the twin-engined aircraft a single pilot is carried, who uses radio-telephony.

Fuel is and will be a fairly expensive item in Iceland, and at present a heavy leaded variety has to be used, which calls for rather special care of engines. The Gipsy Queens, for instance, are being given a top overhaul at 350 to 400 hrs., and a major overhaul at 600 to 700 hrs.

Besides the services between Reykjavik and the outlying centres (Akureyri operated daily in all seasons and the rest two or three times a week) there is a good deal of non-schedule flying. Herring spotting in summer-time has taken on a considerable importance. In bad weather search for boats in trouble due to engine or radio failure is often made by air. Hospital facilities are of a very limited character except in Reykjavik, so that the flying ambulance has become an essential part of modern life. The Beechcraft and the Rapides will take stretchers, but most of the patients are sitting cases.

Since 1942 the passenger traffic has twice doubled itself. Iceland Airways are now firmly and soundly established. Mr. Orn Johnson, the managing director, estimates operational results for 1945 to show 2,500 flying hours or double the amount completed in 1944. The Beechcraft and Rapides will probably fly 600 or 700 hrs. each and the Catalina rather less.

The Icelandic Government has provided funds for some small experimental airfields in a few places around the coast, and a gradual extension and improvement of these facilities is expected.

It is fairly obvious by now that Iceland will be an important stepping-stone for North Atlantic trunk air services. But the possibility of using Iceland for this traffic

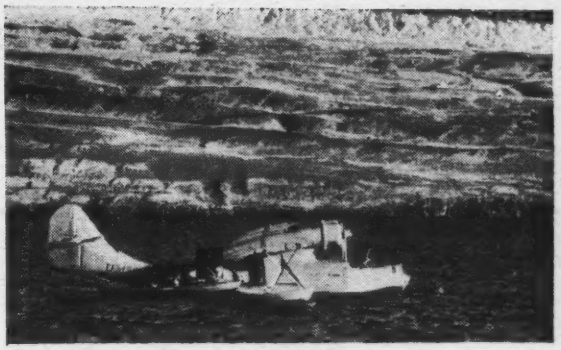
ICELAND AIRWAYS

may depend upon an alternative airfield, perhaps in the north-east, where the weather normally contrasts with that around Reykjavik.

The construction of airfields has never been easy, partly because of the ruggedness of the country and on account of the softness of the soil in some places after the spring thaw. Wheeled aircraft must be used because the snow cover cannot be relied upon in winter, the average temperature in Reykjavik being then about 30 deg. F. and the weather more often rainy than cold. The July mean temperature in Reykjavik is about 52 deg. F. In mid-winter daylight and twilight total about 6 hours, while from May 20th to the end of July there is no darkness at all.

The climate generally is changeable, with plenty of cloud and some severe icing in winter, when there is much low cloud and high wind. Haze is unusual, indeed visibility is often almost unlimited in the winter months. The wind direction is variable, Iceland being in the path of most depressions, and there is a good deal of turbulence among the mountains. On most summer days flying weather is good; there is some morning mist, especially on the north and east coasts, and occasionally there are a few days of fog in the east in April and May.

Potentially, Iceland is an attractive tourist centre.



A Catalina at rest. The aircraft was converted at the Company's workshops to carry 22 passengers.

Before the war it had quite a considerable tourist traffic from England, Denmark, and some from the U.S. and other countries. The winter sports season, so far unexploited, lasts from February to April, and with its wild beauty and location on the transatlantic route and improved air travel services Iceland may well become another Mecca for the air tourist.

CIVIL AVIATION NEWS

A.R.B.

THE Council of the Air Registration Board announce the publication of the following two sub-sections of "British Civil Airworthiness Requirements":—

D.21.—Strength Requirements—Fin and Rudder Loading.

D.22.—Pressure Cabins and Associated Equipment.

VISITOR

SENHOR JOAQUIM PEDRO SALGADO FILHO, Brazil's Minister of Aviation, accompanied by senior officers of his Ministry, is on a visit to this country as a guest of the British Air Ministry.

INFORMATION FOR EXPORT

AIRPORT EQUIPMENT is the title of a brochure to be compiled by R. K. Dundas, Ltd., aeronautical engineers and agents for distribution overseas.

After six years of silence the need for information on British aeronautical equipment is great and the brochure can render excellent service to British airport equipment manufacturers by acquainting overseas customers with their products.

The Amir Faisal of Saudi Arabia boarding a B.O.A.C. aircraft on his journey home.

SWEDISH-ARGENTINA

S.I.L.A., the Swedish inter-continental air lines, are to establish a transatlantic service between Stockholm and Buenos Aires and Rio de Janeiro via Paris, West Africa and Pernambuco.

Experimental flights will start in November, and the service is expected to be in operation early next year.

DANISH PURCHASE

DANSK LUFT TAXA, the Danish air taxi company, is reported to have purchased 14 Percival Proctors. Although new, the aircraft are military versions but can be easily equipped for civilian use.

TO CHANNEL ISLANDS

THE air service to the Channel Islands from Southampton was scheduled to re-open last Monday by the Channel Islands Airways, Ltd. The service will be operated several times daily, and fares are the same for both Jersey and Guernsey at £5 return and £3 single for adults.

It will be recalled that the service from London was resumed on June 21st.

FOR IRAQ

HIS Royal Highness the Emir Abdul Illah, Regent of Iraq, who recently paid a visit to this country, has placed an order for a Miles Messenger aircraft.

SWITCHING OVER

AMERICAN EXPORT AIRLINES' military operation of C-54 aircraft for the Air Transport Command is now being made over a North Atlantic route to Prestwick via Goose Bay Labrador, and Meeks Field, Iceland. This route replaces the southern route to Casablanca.

The switching of operating routes at this time is of paramount importance inasmuch as they closely parallel the two routes recently granted American Export Airlines by the Civil Aeronautics Board. This gives flight crews the opportunity to become familiar with these routes in aircraft similar to those which will be used in the proposed commercial service.

Early operation over the northern route will follow a schedule of two trips a day to Prestwick plus one trip each week to Stockholm. Of the daily trips one will go to Goose Bay and Prestwick, while the other will also stop at Meeks Field. The Stockholm trips will be made via Goose Bay and Meeks Field. As early as possible the Prestwick trips will be increased to three per day.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

From Sir Roy Fedden.

GAS TURBINE DEVELOPMENT

A Valuable Contribution Overlooked

DURING the last year or two many references have been made in *Flight* in regard to historical associations in connection with jet engines and gas turbines.

When preparing the text for my Wilbur Wright lecture in 1944, I made a considerable search in regard to pioneer work on this subject, both in this country and abroad. No mention, however, has been made of a valuable British contribution which has recently been brought to my notice.

I have just returned from a special technical mission to Germany lasting about a month, which I had the honour to lead on behalf of the Minister of Aircraft Production. Attached to our group was Mr. W. J. Stern, of the M.A.P., who acted as interpreter in the many interrogations that were held.

One of the subjects that we were investigating was jet engines, and early on I was impressed with the grasp that Mr. Stern had of the whole subject and the assistance that he gave me in these investigations. On my return, I discovered that he had been employed on thermodynamic investigations at the Air Ministry laboratory as early as 1920, and I have dug up and read with great interest an official publication entitled "The Internal Combustion Turbine" (Engine Sub-Committee Report No. 54, dated September 20th, 1920, published by the Director of Research), compiled by Mr. Stern when he was serving at the Air Ministry laboratory at South Kensington.

This is a most interesting review of 87 pages with a number of illustrations and diagrams. It sets forth the state of the art of the piston aircraft engine at the time (viz., 1920) in relation to the possibilities of the gas turbine, and I cannot understand why it has been missed as I think it is a document of considerable merit and value. I thought therefore that you would be interested for me to call your attention to this report when this subject is so much in the limelight, as I certainly think Mr. Stern should be given credit for having made a valuable contribution to the problem a long time ago.

ROY FEDDEN.

CENTRIFUGAL FORCE

No More Contributions, PLEASE!

THE letter from Flt. Lt. Cohen in our August 16th issue has brought a flood of replies. It is gratifying that so many readers have shown their willingness to help a puzzled reader out of his centrifugal torment, but it is quite impossible to find space for the many letters, and we can only thank our many contributors; the centrifugal force they generated nearly threw us out of our revolving chair. THE EDITOR.

WAR SECRETS

A Somewhat Half-hearted Experiment

IN *Flight*, July 19th, in "Here and There," there is a paragraph headed "Another War Secret," in which is described an experiment made in November, 1940, with a form of aerial mine attached by a length of piano wire to a parachute and dropped in the path of invading bombers.

I submitted just this scheme to the Air Ministry in June, 1939, and was then told that it was an old idea which "did not add to their existing knowledge," and that there was in fact nothing secret about it.

In January, 1941, I again raised the question and was told (in March) that there was nothing to be added to the reply I had received in June, 1939.

What is surprising in the account now published is that it is described as "a desperate defensive measure," that the trial was confined to four obsolete Harrows carrying a total of only 720 mines, and that in spite of this at least three enemy bombers were definitely brought down. Apparently as "only" three were known to have been destroyed the idea was abandoned and operation Mutton was *quite* dead.

On the face of it, this seems to have been a somewhat half-hearted experiment, and the conclusion reached entirely at variance with the comparative success attained.

One wonders—in view of the punishment our cities were then taking from the German bombers—what the results would have been if a sizeable force of the Wellingtons then available had been used with this weapon, in conjunction with radio and searchlight control, on the bomber lanes.

There seems to be something wrong somewhere.

H. E. CARROLL.

[The item, as it appeared in *Flight*, was taken from an official Air Ministry news bulletin.—ED.]

BOMBERS OR ROCKETS

Were the Atomic Bombs Necessary?

IN his article in your issue of September 6th, entitled "Bombers or Rockets," Mr. A. V. Cleaver quotes from a previous article of mine, in which I questioned the effect of bombing in driving a nation to surrender. The words which he quotes were: "We have yet to see if the fate of Japan will afford any evidence." On this Mr. Cleaver comments: "Now indeed we have seen; within ten days of the dropping of two atomic bombs on Hiroshima and Nagasaki, Japan surrendered."

I agree that at first I believed that it was the effect of those two bombs, followed by the Russian declaration of war, which induced the Japanese to surrender. But in *The Times* of September 6th it is reported that a senior official of the Domei News Agency told correspondents that the Emperor had decided as early as June 22nd that Japan must surrender, and told his Cabinet Ministers and Elder Statesmen of his decision. The Emperor, according to this account, did not carry his point at first, and subsequent meetings were held. But he asserted his authority at a final Cabinet meeting on August 14th, and announced that he would broadcast to the people.

If the Domei Agency is believed, it appears that the atomic bombs were not the deciding factor; and, indeed, the position of Japan was already so hopeless that surrender was the only sensible thing.

F. A. DE V. ROBERTSON.

REPORTS AND MEMORANDA

R. and M. 1933: On the Drag of Circular Cylinders at High Speeds. By A. E. Knowler, M.Sc., Ph.D., and F. W. Pruden, of the Aerodynamics Division, N.P.L. 10 pp., 19 diag., Feb. 18th, 1944. 2s. 6d. net.

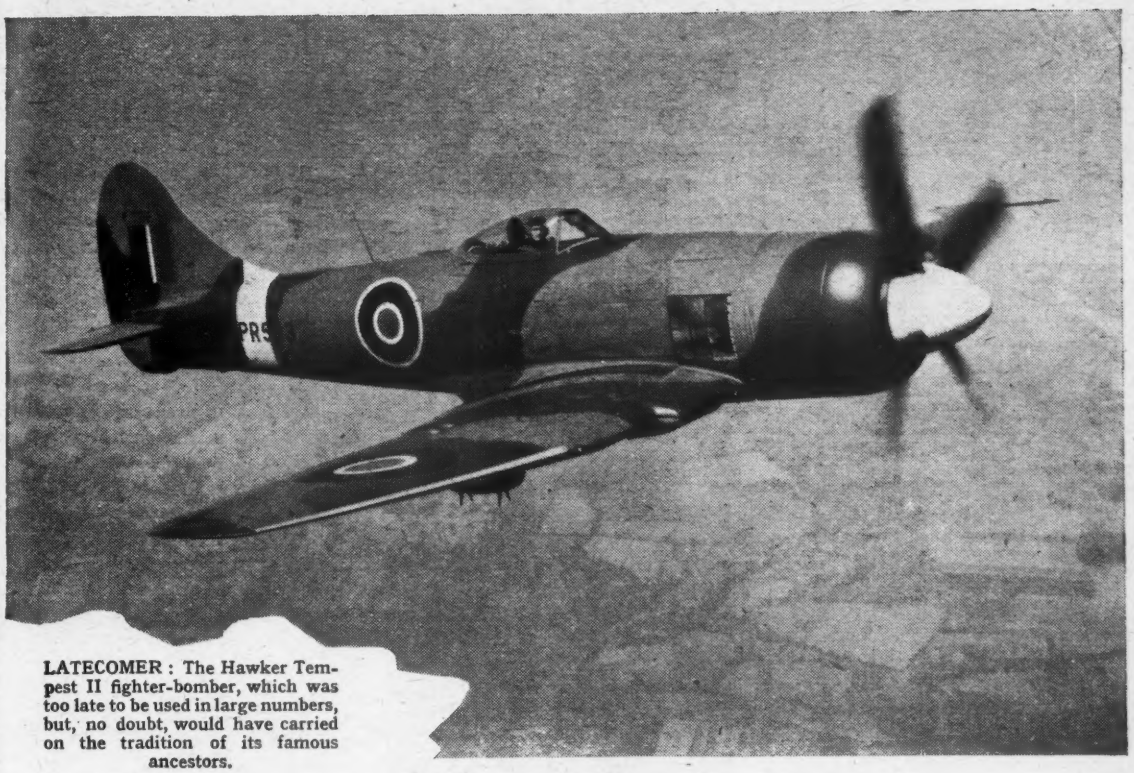
Measurements have been made of the drag of circular cylinders of $\frac{3}{16}$ to 11in. diameter at speeds up to M=0.85 by means of the electrical balance in the Circular High-speed Tunnel and by pressure plotting round cylinders of $\frac{3}{16}$in. and $\frac{1}{4}$in. diameter in the Rectangular High-speed Tunnel. The measurements were confined in the main to cylinders which did not show the usual critical drop in C_D at a Reynolds number near 0.25×10^6. The value of C_D started to rise at about M=0.35, after which it rose at an increasing rate to a maximum at about M=0.7; this was succeeded by a minimum at M=0.75 and a sharp rise at M=0.85. The speeds at which the maxima and minima of the curves occurred for cylinders of various diameters were used to correct for tunnel interference in the circular tunnel. Photographs were taken of the shock wave system in the Rectangular Tunnel at various speeds.

R. and M. 1951: The Measurement of Tailplane Stiffness. By J. Taylor, B.A., Communicated by the Director of Scientific Research, Ministry of Aircraft Production. 7 pp., 3 diag., July, 1939. 1s. 6d. net.

In view of the possible necessity for a stiffness requirement for tailplanes and to assist research work on tailplane flutter, static tests have been made of a number of tailplanes to provide typical stiffness data. As the section to which the requirements would apply has still to be defined, tests were made at two sections suitably positioned to allow of estimation of the stiffness over a considerable span of the tailplane.

A method has been evolved from the tests which should be satisfactory for routine use on all types of tailplane design.

An appendix deals with the design of the wooden frames used to apply the loading.



LATECOMER : The Hawker Tempest II fighter-bomber, which was too late to be used in large numbers, but, no doubt, would have carried on the tradition of its famous ancestors.

SERVICE AVIATION

Royal Air Force and Naval Air Arm News and Announcements

Awards

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations.

Distinguished Service Order

Act. Group Capt. D. S. MACDONALD, D.F.C., R.A.F.—Group Capt. MacDonald has been in command of a wing in the Balkan Air Force from its formation in July, 1944, until its disbandment in May, 1945. During that period the wing has attacked a large variety of ground targets, involving deep penetration into enemy held territory and flying over mountainous country, often in adverse weather. Under the brilliant and courageous leadership of this officer many notable successes have been achieved and the wing has maintained a high standard of operational efficiency. Group Capt. MacDonald has personally led many of these sorties and on at least two occasions has flown his aircraft back, badly damaged by enemy ground fire. In December, 1944, this officer led a combined naval and air bombardment against minor war vessel bases on Lussin Island. Despite very heavy anti-aircraft fire he remained over the target area for some 80 minutes, to liaise between the attacking air and ground forces and to lead in each wave of attacking aircraft. His fine fighting spirit and cool courage very largely contributed to the excellent results obtained on this occasion, which virtually ended the effective use of this base by the enemy.

Wing Cdr. J. C. MILLAR, R.A.F., No. 178 Sqn.—This officer assumed command of his squadron in October, 1944. Both in the air and on the ground, he has set a magnificent example and under his inspiring leadership excellent results have been obtained. On one occasion in March, 1945, Wing Cdr. Millar was detailed, as captain of aircraft for a low-level mine-laying operation in the harbour of Venice. Though subjected to heavy fire from the enemy's defences the operation was most successfully completed. Later in the same month, this officer was captain of an aircraft detailed for an attack on the railway sidings at Graz. Opposition was intense, both from the enemy's ground batteries and from fighter aircraft; nevertheless, Wing Cdr. Millar pressed home a determined attack.

Act. Wing Cdr. G. W. GARTON, D.F.C., R.A.F.V.R.—This officer has a long and distinguished record of operational flying and is now on his third tour of duty. Since the award of the D.F.C. he has led a large number of highly successful missions. Both in the air and on the ground, Wing Cdr. Garton has displayed outstanding leadership and by his fine fighting spirit, cool courage and devotion to duty, he has set an inspiring example to all under his command. In air combat this officer has destroyed at least eight enemy aircraft.

Act. Wing Cdr. L. E. LEON, D.F.C., R.A.F.V.R., No. 55 Sqn.—Since the award of a Bar to the D.F.C., this officer has taken part in a large number of operational sorties. He is an outstanding pilot and squadron commander who has succeeded in instilling his own fine fighting spirit into the squadron he commands. On one occasion it was necessary to destroy an important enemy bridge at Polesella. Wing Cdr. Leon volunteered to execute an extremely low level attack with his aircraft and one other. Having completed one attack, he made a second extremely low level attack and obtained hits on the mooring points of the bridge. At the end of the operation, which lasted for some 15 minutes, Wing Cdr. Leon made repeated low level reconnaissances to ascertain the damage inflicted on the bridge. The enemy defences were then fully roused, and on each occasion he met increasing opposition. The skilful leadership and cool courage of this officer were largely responsible for the successful completion of this mission.

Act. Wing Cdr. E. B. R. LOCKWOOD, M.B.E., R.A.F.V.R., No. 614 Sqn.—Throughout a long and distinguished operational career, Wing Cdr. Lockwood has displayed outstanding leadership, great skill and unfailing devotion to duty. He has successfully directed six major night attacks against well-defended targets. The results of his cool and accurate bombing directions when under fire are reflected in the outstanding results achieved. In April, 1945, this officer directed a full-scale night attack against the strongly held enemy line, south-east of Bologna and only 2,000 yards in front of the Eighth Army troops. His careful planning and masterful control of the attack resulted in a highly successful bombing concentration and gave valuable support to the ground forces.

Sqn. Ldr. H. A. LANGTON, D.F.C., R.A.F.V.R., No. 37 Sqn.—Throughout two tours of operational duty Sqn. Ldr. Langton has shown outstanding courage and determination and has led a large number of attacks against heavily defended targets. A typical example of his coolness in the face of the enemy took place in November, 1944. This officer was detailed for a daylight attack against a well-defended bridge in Yugoslavia. Despite the very heavy anti-aircraft fire, he made a straight run over the target at 9,500ft., released his bombs and secured an excellent photograph. Both in the air and on the ground, Sqn. Ldr. Langton has set an inspiring example and, largely owing to his untiring efforts and devotion to duty, the squadron has attained a high standard of operational efficiency.

Act. Sqn. Ldr. S. W. DANIEL, D.F.C., R.A.F., No. 115 Sqn.—This officer has a long and distinguished record of operational service. He was awarded a bar to the D.F.C. in 1943, and since then he has led his squadron in numerous successful missions. In December, 1944, while flying on a close support operation, his aircraft was hit by anti-aircraft fire and he was forced to crash land it in difficult country. After some weeks in hospital, Sqn. Ldr. Daniel resumed operational flying with undiminished enthusiasm. A typical example of this officer's perseverance took place in August, 1945. Returning from a sortie without any ammunition he located some enemy transport. After landing he had his aircraft re-armed and re-fuelled and took off again and subsequently destroyed or badly damaged ten enemy vehicles, comprising practically one convoy. Under the inspiring leadership of this officer, his squadron have harassed and disorganised the enemy's lines of communication, inflicting serious damage or destroying numerous mechanical transports and barges. Squadron Ldr. Daniel has himself destroyed at least 14 enemy aircraft in air combat.

Act. Sqn. Ldr. I. H. H. SHAND, D.F.C., R.A.F.V.R., No. 237 Sqn.—Sqn. Ldr. Shand has

SERVICE AVIATION

completed two tours of operational duty throughout which he has displayed outstanding leadership, energy and enthusiasm. Flying regularly with his squadron, he has invariably shown a high degree of courage and determination and has instilled into his crew his own fighting spirit and efficiency. Under this officer's gallant leadership, his squadron has caused considerable destruction to the enemy's transport movements and communications in the Po Valley.

Sqn. Ldr. M. P. NASH, D.F.C., R.A.A.F., No. 3 (R.A.A.F.) Sqn.—Since the award of a Bar to the D.F.C. this officer has flown on numerous operational sorties. He has led his squadron in attacks against enemy lines of communications in Yugoslavia and Northern Italy and has inflicted considerable destruction to the enemy's locomotives, mechanical transport, bridges, rolling stock and supply dumps. On many occasions Sqn. Ldr. Nash has attacked and silenced enemy anti-aircraft positions before permitting his squadron to attack. In December, 1944, he was detailed to lead four squadrons in an attack on the railway sidings at Bjelovar. The target area was found to be obscured by thick clouds. Leaving the formation Sqn. Ldr. Nash, after repeated attempts, located an avenue of approach and led his squadron to the target. Despite the heavy anti-aircraft fire he then led the remaining squadrons one by one to the target. This incident is typical of this officer's outstanding determination and ability to press home his attacks.

Flt. Lt. (Hon.) A. J. BROWN-BARTROLLI, R.A.F.V.R.

Bar to Distinguished Flying Cross

Act. Wing Cdr. D. P. PATON, D.F.C., R.A.F.V.R. No. 114 Sqn.
Flt. Lt. J. B. SCOTT, R.A.F.V.R., No. 454 (R.A.A.F.) Sqn.
Lt. Col. R. M. COULL, D.F.C., S.A.A.F., No. 12 (S.A.A.F.) Sqn.
Maj. S. A. FINNEY, D.F.C., S.A.A.F., No. 2 (S.A.A.F.) Sqn.
Capt. W. L. O. MOON, D.F.C., S.A.A.F., No. 2 (S.A.A.F.) Sqn.
Lt. Col. D. ORD, D.F.C., S.A.A.F., No. 21 (S.A.A.F.) Sqn.

Distinguished Flying Cross

Wing Cdr. D. E. B. WHEELER, R.A.F., No. 13 Sqn.
Act. Wing Cdr. H. N. CARBETT, R.A.F., No. 500 Sqn.
Act. Sqn. Ldr. C. T. BELL, R.A.F.V.R.
Act. Sqn. Ldr. C. V. BOYLE, R.A.F.V.R., No. 13 Sqn.
Act. Sqn. Ldr. M. V. CHRISTOPHERSON, R.A.F.V.R., No. 185 Sqn.
Act. Sqn. Ldr. J. F. W. ELLIOTT, R.A.F.V.R., No. 55 Sqn.
Act. Sqn. Ldr. R. D. M. EVERS, R.A.F.V.R., No 500 Sqn.
Act. Sqn. Ldr. J. KEEGAN, R.A.F.V.R., No. 178 Sqn.
Act. Sqn. Ldr. L. W. J. MONCRIEFF, R.A.F., No. 614 Sqn.
Act. Sqn. Ldr. R SLADE-BETTS, R.A.F.V.R., No. 6 Sqn.
Act. Sqn. Ldr. V. S. SWAIN, R.A.F.V.R.
Act. Sqn. Ldr. R. G. WILSON, R.A.F.V.R., No. 614 Sqn.
Act. Sqn. Ldr. E. WINTERBOTTOM, R.A.F., No. 70 Sqn.
Flt. Lt. T. H. E. B. ASHWORTH, R.A.F.V.R., No. 249 Sqn.
Flt. Lt. J. BREINGAN, R.A.F.V.R., No. 208 Sqn.
Flt. Lt. R. ST. C. FEARON, R.A.F., No. 208 Sqn.
Flt. Lt. G. L. GARNHAM, R.A.F.V.R., No. 185 Sqn.
Flt. Lt. D. R. HARPER, R.A.F.V.R., No. 13 Sqn.
Flt. Lt. E. HOWEY, R.A.F.V.R., No. 225 Sqn.
Flt. Lt. G. S. HULSE, R.A.F., No. 213 Sqn.
Flt. Lt. R. T. H. MACFARLANE, R.A.F.V.R., No. 683 Sqn.
Flt. Lt. E. J. PEARSON, R.A.F.V.R., No. 87 Sqn.
Flt. Lt. R. RAYNER, R.A.F.V.R., No. 72 Sqn.
Flt. Lt. J. RENNOLDS, R.A.F.V.R., No. 114 Sqn.
Flt. Lt. H. R. SHEPHARD, R.A.F.V.R., No. 55 Sqn.
Act. Flt. Lt. H. COOK, R.A.F.V.R., No. 37 Sqn.
Act. Flt. Lt. V. EVANS, R.A.F.V.R., No. 43 Sqn.
Act. Flt. Lt. T. E. JOHNSON, R.A.F.V.R., No. 601 Sqn.
Act. Flt. Lt. A. SUTHERLAND, R.A.F.V.R., No. 111 Sqn.
Act. Flt. Lt. P. O'K. YARROW, R.A.F., No. 40 Sqn.
F/O. C. J. BARREY, A.F.C., D.F.M., R.A.F., No. 450 (R.A.A.F.) Sqn.
F/O. C. I. COLQUHOUN, R.A.F.V.R., No. 111 Sqn.
F/O. R. A. DAY, R.A.F.V.R., No. 253 Sqn.
F/O. R. A. ELLIOTT, R.A.F.V.R., No. 3C (S.A.A.F.) Sqn.
F/O. J. T. FEENEY, R.A.F.V.R., No. 73 Sqn.
F/O. G. N. HINGLEY, R.A.F.V.R., No. 70 Sqn.
F/O. J. RAWSON, R.A.F.V.R., No. 682 Sqn.
F/O. J. SCOLLAN, R.A.F.V.R., No. 255 Sqn.
F/O. L. W. A. STRETCH, R.A.F.V.R., No. 185 Sqn.
F/O. J. J. WEBB, R.A.F.V.R., No. 253 Sqn.
F/O. B. A. WHITWORTH, R.A.F.V.R., No 225 Sqn.
P/O. K. A. GREENWELL, R.A.F.V.R., No. 614 Sqn.
P/O. H. B. HOLMAN, R.A.F.V.R., No. 6 Sqn.
P/O. A. J. B. WHITE, R.A.F.V.R., No. 6 Sqn.
P/O. F. YOUNG, R.A.F.V.R., No. 614 Sqn.
W/O. S. DAVIES, R.A.F.V.R., No. 31 (S.A.A.F.) Sqn.
W/O. I. C. ROBINSON, R.A.F.V.R., No. 213 Sqn.
Act. Sqn. Ldr. J. C. DOYLE, R.A.A.F., No. 450 (R.A.A.F.) Sqn.
Act. Sqn. Ldr. C. E. EDMONDSON, R.A.A.F., No. 249 Sqn.
Act. Sqn. Ldr. C. B. STINSON, R.A.A.F., No. 454 (R.A.A.F.) Sqn.
Flt. Lt. C. F. C. FORSSTROM, R.A.A.F., No. 450 (R.A.A.F.) Sqn.
Flt. Lt. F. M. GAMBLE, R.A.A.F., No. 213 Sqn.
Flt. Lt. C. B. SNOOK, R.A.A.F., No. 37 Sqn.
Flt. Lt. J. C. WRIGHT, R.A.A.F., No. 454 (R.A.A.F.) Sqn.
F/O. J. R. BULLOCK, R.A.A.F., No. 500 Sqn.
F/O. G. JACK, R.A.A.F., No. 682 Sqn.
F/O. R. Y. ULRICH, R.A.A.F., No. 6 Sqn.
Flt. Lt. B. W. PROCTOR, R.C.A.F., No. 601 Sqn.
F/O. J. H. ATKINSON, R.C.A.F., No. 272 Sqn.
F/O. N. J. PEARCE, R.C.A.F., No. 73 Sqn.
F/O. T. H. ROSS, R.N.Z.A.F., No. 601 Sqn.
F/O. B. CLEGG, R.N.Z.A.F., No. 608 Sqn.
F/O. L. W. CROWE, R.N.Z.A.F., No. 15 Sqn.
F/O. W. J. K. ENDEAN, R.N.Z.A.F., No. 50 Sqn.
F/O. G. B. GREEN, R.N.Z.A.F., No. 608 Sqn.
F/O. D. G. HANNIGAN, R.N.Z.A.F., No. 142 Sqn.
F/O. F. E. H. MILLAR, R.N.Z.A.F., No. 630 Sqn.
F/O. A. C. MITCHELL, R.N.Z.A.F., No. 51 Sqn.
F/O. I. J. WILLIAMSON, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
Act. F/O. R. M. MACKAY, R.N.Z.A.F., No. 195 Sqn.
P/O. J. McL. GADDES, R.N.Z.A.F., No. 77 Sqn.
P/O. J. WATT, R.N.Z.A.F., No. 162 Sqn.
Act. Sqn. Ldr. T. R. LEE, R.C.A.F., No. 357 Sqn.
Flt. Lt. W. W. C. P. SHACKET, R.A.F.V.R., No. 191 Sqn.
Flt. Lt. G. E. SHARP, R.A.F.V.R., No. 570 Sqn.
Flt. Lt. R. F. SIMPSON, R.A.F.V.R., No. 435 (R.C.A.F.) Sqn.
W/O. A. M. WARBURTON, R.A.F., No. 62 Sqn.
Sqn. Ldr. G. HARVEY, R.N.Z.A.F., No. 7 Sqn.
Flt. Lt. T. A. EMPSON, R.N.Z.A.F., No. 128 Sqn.
Flt. Lt. A. A. HAYDON, R.N.Z.A.F., No. 15 Sqn.
Flt. Lt. A. C. RELPH, R.N.Z.A.F., No. 109 Sqn.

Air Vice-Marshal J. N. Boothman, C.B., D.F.C., A.F.C., Assistant C.A.S., Technical Requirements.

Flt. Lt. G. A. RUSSELL, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
Flt. Lt. L. G. SMITH, R.N.Z.A.F., No. 128 Sqn.
Flt. Lt. R. G. WILLIAMS, R.N.Z.A.F., No. 90 Sqn.
Act. Flt. Lt. S. LEWIS, R.N.Z.A.F., No. 635 Sqn.
Act. Flt. Lt. W. STIRLING, R.N.Z.A.F., No. 115 Sqn.
Flt. Lt. A. R. EASTON, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
Flt. Lt. S. P. KELLY, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
Flt. Lt. I. A. LITCHFIELD, R.A.A.F., No. 142 Sqn.
Flt. Lt. P. J. MCNULTY, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
Flt. Lt. A. E. ROACH, R.A.A.F., No. 192 Sqn.
Flt. Lt. E. G. STROM, R.A.A.F., No 617 Sqn.
Act. Flt. Lt. G. T. BROWN, R.A.A.F., No. 582 Sqn.
Act. Flt. Lt. K. A. EVANS, R.A.A.F., No. 7 Sqn.
Act. Flt. Lt. H. J. GRAY, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Act. Flt. Lt. J. S. HUTTON, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
Act. Flt. Lt. A. R. KOPP, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
Act. Flt. Lt. A. L. MCHUGH, R.A.A.F., No. 622 Sqn.
Act. Flt. Lt. R. J. MOLYNEAUX, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
Act. Flt. Lt. K. M. MOSS, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
Act. Flt. Lt. C. L. OTTAWAY, R.A.A.F., No. 635 Sqn.
Act. Flt. Lt. K. A. ROBBETSON, R.A.A.F., No. 218 Sqn.
Act. Flt. Lt. J. N. CARSON, R.C.A.F., No. 116 Sqn.
Act. Flt. Lt. C. A. CHARTIER, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
Flt. Lt. C. A. THOMPSON, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
Flt. Lt. D. P. THOMPSON, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
Flt. Lt. G. J. WILLIAMS, R.C.A.F., No. 427 (R.C.A.F.) Sqn.
Flt. Lt. J. H. WOODS, R.C.A.F., No. 101 Sqn.
Act. Flt. Lt. V. L. BARR, R.C.A.F., No. 434 (R.C.A.F.) Sqn.
Act. Flt. Lt. J. S. BRAY, R.C.A.F., No. 625 Sqn.
Act. Flt. Lt. H. J. COLLSON, R.C.A.F., No. 156 Sqn.
Act. Flt. Lt. L. R. DERYCKERE, R.C.A.F., No. 426 (R.C.A.F.) Sqn.
Act. Flt. Lt. G. A. ECCLESTONE, R.C.A.F., No. 434 (R.C.A.F.) Sqn.
Act. Flt. Lt. G. T. J. FIDLER, R.C.A.F., No. 426 (R.C.A.F.) Sqn.
Act. Flt. Lt. W. FIKIS, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
Act. Flt. Lt. N. G. GORDON, R.C.A.F., No. 158 Sqn.
Act. Flt. Lt. R. B. HOUSTON, R.C.A.F., No. 158 Sqn.
Act. Flt. Lt. J. E. L. JOHN, R.C.A.F., No. 150 Sqn.
Act. Flt. Lt. J. H. LAWSON, R.C.A.F., No. 428 (R.C.A.F.) Sqn.
Act. Flt. Lt. A. D. LEWIS, R.C.A.F., No. 434 Sqn.
Act. Flt. Lt. M. W. MACDONALD, R.C.A.F., No. 76 Sqn.
Act. Flt. Lt. J. V. MULHOLLAND, R.C.A.F., No. 427 (R.C.A.F.) Sqn.
Act. Flt. Lt. E. H. OAKLEY, R.C.A.F., No. 420 (R.C.A.F.) Sqn.
Act. Flt. Lt. S. T. ORSER, R.C.A.F., No. 76 Sqn.
Act. Flt. Lt. A. G. RAYNER, R.C.A.F., No. 78 Sqn.
Act. Flt. Lt. J. A. SCHOLLAR, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
Act. Flt. Lt. G. A. SHERWOOD, R.C.A.F., No. 115 Sqn.
Act. Flt. Lt. F. W. SKINNER, R.C.A.F., No. 420 (R.C.A.F.) Sqn.
Act. Flt. Lt. R. B. TELFORD, R.C.A.F.V.R., No. 434 (R.C.A.F.) Sqn.
Act. Flt. Lt. G. MCN. TEMPLETON, R.C.A.F., No. 186 Sqn.
Act. Flt. Lt. G. M. TEGERDINE, R.C.A.F., No. 427 (R.C.A.F.) Sqn.
Act. Flt. Lt. J. E. WILLIS, R.C.A.F., No. 153 Sqn.
F/O. F. J. BAPTISE, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
F/O. G. A. H. BARRON, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
F/O. G. R. BISHOP, R.C.A.F., No. 153 Sqn.
F/O. F. B. BOLTON, R.C.A.F., No. 153 Sqn.
F/O. A. A. W. BOURNE, R.C.A.F., No. 582 Sqn.
F/O. W. A. BOYCE, R.C.A.F., No. 153 Sqn.
F/O. J. E. BREARLEY, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. D. H. BUDREAU, R.C.A.F., No. 158 Sqn.
F/O. A. A. BULBECK, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
F/O. F. W. BULLEN, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
F/O. J. G. A. CHAPUT, R.C.A.F., No. 428 (R.C.A.F.) Sqn.
F/O. P. CODD, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
F/O. W. G. CONLIN, R.C.A.F., No. 10 Sqn.
F/O. J. L. COPE, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. J. J. COPPINGER, R.C.A.F., No. 161 Sqn.
F/O. L. P. M. R. COTÉ, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
F/O. J. E. CULLEY, R.C.A.F., No. 433 (R.C.A.F.) Sqn.
F/O. M. C. J. DALE, R.C.A.F., No. 166 Sqn.
F/O. J. P. DE LALLA, R.C.A.F., No. 427 (R.C.A.F.) Sqn.
F/O. R. DILL, R.C.A.F., No. 405 (R.C.A.F.) Sqn.

Conspicuous Gallantry Medal (Flying)

Flt. Sgt. D. T. JONES, R.A.F.V.R., No. 62 Sqn.—This airman has completed a large number of day and night sorties, many of which have been over mountainous terrain and in adverse weather. In May, 1945, his aircraft was hit and set on fire by anti-aircraft fire. Handing over control of the aircraft to his second pilot, Flt. Sgt. Jones attempted to extinguish the flames. His efforts proved unsuccessful and he sustained burns. Upon resuming control of the aircraft, he realised that there was no alternative but to make a forced landing as the fire was spreading rapidly. Shortly after landing the aircraft exploded. His ability and coolness undoubtedly saved the lives of his crew. This airman has set a fine example to his fellows.

(Left) Badge of No. 212 Sqn., R.A.F.—"A Mari ad Astra" (From the Sea to the Stars). (Right) Badge of No. 218 Sqn., R.A.F.—"In Time."

SERVICE AVIATION

Distinguished Flying Medal

Flt. Sgt. L. CLATWORTHY, R.A.F.V.R., No. 87 Sqn.
Flt. Sgt. T. D. FINLAY, R.A.F.V.R., No. 249 Sqn.
Flt. Sgt. C. J. GOODFELLOW, R.A.F.V.R., No. 18 Sqn.
Flt. Sgt. E. J. HENRICK, R.A.F.V.R., No. 601 Sqn.
Flt. Sgt. C. J. HIGGS, R.A.F.V.R., No. 18 Sqn.
Flt. Sgt. C. G. HURST, R.A.F.V.R., No. 37 Sqn.
Flt. Sgt. R. T. LITTLEWOOD, R.A.F.V.R., No. 111 Sqn.
Flt. Sgt. W. PINNER, R.A.F.V.R., No. 111 Sqn.
Flt. Sgt. R. W. RAYSON, R.A.F.V.R., No. 87 Sqn.
Flt. Sgt. B. ROBERTSHAW, R.A.F.V.R., No. 500 Sqn.
Flt. Sgt. J. C. SAMAIN, R.A.F.V.R., No. 18 Sqn.
Flt. Sgt. R. S. THURNHAM, R.A.F.V.R., No. 18 Sqn.
Flt. Sgt. L. D. WALKER, R.A.F.V.R., No. 13 Sqn.
Flt. Sgt. H. WILKINSON, R.A.F.V.R., No. 43 Sqn.
Flt. Sgt. J. YATES, R.A.F.V.R., No. 6 Sqn.

THE KING has been graciously pleased to approve the following awards:—

O.B.E. (Mil.)

Flt. Lt. T. G. GLASHEEN, R.A.A.F.
Lt. C. J. du P. DE CLERK, S.A.A.F.
Act. Flt. Lt. H. FOSTER, R.A.F.V.R.
F/O. G. H. BELL, R.A.F.V.R.
F/O. J. BRANFORD, R.A.F.V.R.
F/O. R. K. MCCREADIE, R.A.F.V.R.
F/O. A. D. STEPHENS, R.A.F.V.R.
Act. Sqn. Ldr. A. N. ROTH, R.C.A.F.
Flt. Lt. J. P. GILLESPIE, R.A.F.V.R.
Flt. Lt. F. W. LAURIE, R.A.F.V.R.
Act. Flt. Lt. C. C. BOOTH, R.A.F.V.R.
Act. Flt. Lt. H. A. COX, R.A.F.V.R.

B.E.M. (Mil.)

A/C.1 L. J. SALDANHA, R.I.A.F.
L.A/C. T. S. FERGUS, R.A.F.

Military Cross

Flt. Lt. G. H. AVERY, R.C.A.F., 5th Infantry Brigade, 2nd British Division, 33rd Indian Corps, Burma.

Military Medal

Sgt. P. COLGAN, R.A.F., att. 5th Infantry Brigade, 2nd British Division, 33rd Indian Corps, Burma.

Roll of Honour

Casualty Communiqué No. 536.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 202 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. R. Armstrong; Sgt. K. C. Ashun, Flt. Sgt. R. Brothwood; F/O. W. F. Calderbank; Flt. Sgt. E. A. Cattell; Flt. Lt. W. R. Cressy-Marcks; P/O. P. J. Culligan; Flt. Sgt. G. A. Dane; Sgt. J. N. David; P/O. A. C. J. Falkenstein; Flt. Lt. A. W. Hirons, D.F.C.; Flt. Sgt. G. E. J. Holmes; Flt. Sgt. W. C. Pamment; W/O. A. G. K. Prater; Flt. Lt. H. S. Priest; Sgt. A. Ramsbottom; Flt. Sgt. P. C. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. K. R. Baker; F/O. H. H. G. Davis; F/O. D. Draper; Flt. Lt. E. R. Moseley; Flt. Lt. A. S. Williams.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. W. T. Alsbury; F/O. F. S. Barnsdale; Sgt. R. O. Barrs; F/O. H. W. Batt; Sgt. C. J. Boreham; Flt. Lt. G. C. Brown; Sgt. R. E. Buzza; Sgt. E. H. Charlton; Sgt. C. Clamp; Sgt. F. C. Clarke; Sgt. W. S. Clarke; Sgt. J. Cochrane; Flt. Sgt. F. C. Coker; Sgt. R. S. Conroy; Sgt. G. Cranston; Flt. Sgt. W. Cully; Sgt. R. M. Dand; Sgt. R. Duffy; Sgt. K. R. Dye; F/O. N. J. Fairbairn; Sgt. K. Garner; Act. Flt. Lt. L. D. Goldingay, D.F.C.; Act. Flt. Lt. A. J. Grain, D.F.M.; Sgt. J. Heaney; Flt. Lt. J. H. Inns; Sgt. D. A. Johnson; Sgt. A. T. G. Jones; Sgt. C. R. Knapman; Sgt. R. W. Lloyd; Flt. Sgt. W. E. Lock; Sgt. R. D. Loke; Flt. Sgt. P. Long-Hartley; Flt. Sgt. J. G. McGarva; P/O. N. McA. McGaw; Sgt. A. Maclean; F/O. J. MacPherson; Act. Sqn. Ldr. J. L. Martin, D.F.C.; Sgt. W. C. Maxwell; Flt. Sgt. G. R. S. Miller; Sgt. S. H. Mills; P/O. M. B. Millward; Sgt. W. Milner; Flt. Sgt. K. B. Milton; Sgt. G. M. Morris; P/O. R. Murphy; Sgt. J. W. Nelson; Sgt. G. E. O'Neill; F/O. A. J. Painter; Sgt. N. Pearce; Sgt. W. C. Pearce; Flt. Lt. A. Pennington; Sgt. J. W. Ranger; Sgt. S. Rennie; Act. Sqn. Ldr. G. Ryle, D.F.C.; Flt. Sgt. R. P. Scott; F/O. F. Shield, D.F.C.; Sgt. F. W. Shields; Sgt. R. A. Sneddon; Sgt. E. G. Sneyd; Sgt. J. L. Stephenson; Sgt. T. W. Sykes; Sgt. R. J. Tailby; Sgt. V. W. G. Torbett; P/O. N. J. Tutt; Act. Flt. Lt. G. D. Urich; Flt. Sgt. R. H. Valencia; Sgt. T. W. Varey; Sgt. K. Waddington; Wing Cdr. A. Warburton, D.S.O., D.F.C.; Sgt. R. Watson; Flt. Sgt. J. A. Whyte; F/O. W. T. Williams.

WOUNDED OR INJURED IN ACTION.—Sgt. J. Backhouse; W/O. J. E. Chalk; Flt. Sgt. J. Fyfe; Flt. Lt. P. L. Scott; Flt. Sgt. D. A. Sime; W/O. R. B. Tammas; Sgt. D. S. Turney; Flt. Sgt. H. J. Wood.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. W. S. Searby.

MISSING, BELIEVED KILLED IN ACTION.—W/O. P. J. Heeley; F/O. W. R. MacLaren.

MISSING.—Flt. Sgt. W. N. Birkett; Sgt. P. J. Brown; Sgt. W. J. Carlyle; F/O. W. G. Chatteris; Flt. Sgt. J. C. Davis; Sgt. G. E. Emerson; W/O. J. A. Etchells; Flt. Sgt. J. G. Fraser; Flt. Lt. B. K. L. Fuge; Flt. Sgt. R. T. Galloway; Sgt. G. R. Grimsdell; Sgt. K. Grundy; F/O. G. A. Hall; P/O. S. J. Harrop; Flt. Sgt. H. W. G. Hart; Flt. Sgt. I. A. Hay; Sgt. E. G. Hick; F/O. H. A. Hunt; F/O. W. T. Jackson; Flt. Lt. R. D. Jeff; Sgt. D. A. Little; P/O. K. McCall; Flt. Sgt. G. McChrystal; Flt. Lt. S. E. Miller; F/O. J. E. Millis; Sgt. A. C. Phillips; Flt. Sgt. D. L. Pratt; W/O. G. C. Redmond; F/O. J. R. W. Shaw; Act. Flt. Lt. W. J. B. Stark; Flt. Sgt. V. J. Sutherland; Flt. Sgt. P. C. Sweetman; F/O. H. G. Underwood; F/O. R. Warrington; Flt. Sgt. R. H. Welsh.

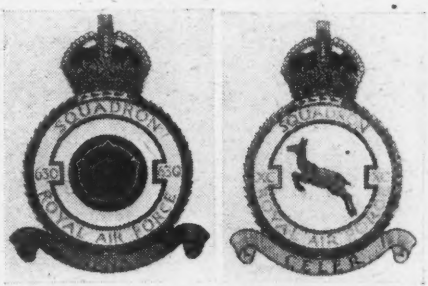
MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Lt. G. H. Ellis; Sgt. W. P. Reidy.

KILLED ON ACTIVE SERVICE.—Cpl. M. Braham; Cpl. A. V. Bryce; W/O. C. H. Fletcher; L.A/C. A. McI. Fulton; F/O. S. C. Gale; Sgt. H. R. Hollings; Flt. Sgt. S. D. Lazarus; Flt. Sgt. A. D. McGillivray; Sgt. W. G. McInnes; F/O. G. W. Maddock; Sgt. J. D. Matthews; Cpl. J. Michie; Sgt. R. W. Rodie; F/O. J. E. Shaw; W/O. J. Skinner, D.F.C.; Sgt. G. Williams; W/O. G. G. Willins.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. W. Graham; L.A/C. C. S. Hart; L.A/C. S. E. Johnston; Sgt. V. O. Lindo; Sgt. J. J. Waterson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. J. S. Pearce.

DIED ON ACTIVE SERVICE.—L.A/C. B. W. Bills; A/C.1 T. Boland; L.A/C. E. C. Burgess; A/C.2 A. J. Carpenter; L.A/C. W. Cartwright; L.A/C. P. Channon; L.A/C. C. E. Cook; Cpl. H. A. Cook; L.A/C. W. J. Esposti; L.A/C. B. E. Higgins; L.A/C. C. T. E. Hoare; L.A/C. J. Lamb; L.A/C. A. G. Little; F/O. T. Oliver; L.A/C. E. A. Smith; Sgt. S. Smith; L.A/C. W. Stewart; Cpl. N. J. Sutherland; L.A/C. T. B. Tate; L.A/C. A. J. Walters.



(Left) Badge of No. 630 Sqn., R.A.F.—"Nocturna Mors" (Death by Night). (Right) Badge of No. 90 Sqn., R.A.F.—"Celer" (Swift).

Royal Australian Air Force

KILLED IN ACTION.—P/O. G. S. Browne; F/O. C. A. Cobern; Flt. Sgt. L. W. Grant; W/O. G. T. McBryde; W/O. A. E. Moss; Flt. Sgt. R. C. Schodde; Flt. Sgt. J. Stacey; Flt. Lt. A. W. Waugh.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. W. J. Leahy; W/O. J. D. Murphy; P/O. J. M. Palmer; P/O. J. H. Porter; P/O. W. E. Rosser.

WOUNDED OR INJURED IN ACTION.—F/O. L. R. Corrigan; Flt. Lt. H. P. Vanrenen.

MISSING, BELIEVED KILLED IN ACTION.—W/O. F. N. Leamon.

MISSING.—P/O. B. A. S. Abbott; Flt. Sgt. J. D. Bryant; P/O. G. L. Burgess; F/O. M. Callas; Flt. Sgt. J. N. Griffin; Flt. Sgt. K. A. Kee; Flt. Sgt. R. L. Masters; W/O. R. W. Moffatt; F/O. P. H. Morris; W/O. G. D. Mummery; F/O. A. F. Rowe; P/O. J. H. Tinsley.

KILLED ON ACTIVE SERVICE.—F/O. L. W. Marshall.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. W. V. Blake, D.F.C.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. N. T. Andrews; F/O. M. L. Cameron; P/O. D. N. Cotton; Flt. Lt. T. P. Jarvis; W/O. J. H. Munroe; F/O. L. E. Park; W/O. D. J. Scott; P/O. C. E. Towsley.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. M. R. Bell; P/O. V. H. Bernyk; F/O. H. F. S. Best; P/O. J. A. Blasko; P/O. J. A. Bourgeault; F/O. E. O. Aaron; P/O. W. M. Aldred; W/O. W. B. Baldwinson; P/O. R. J. Barber; P/O. P. J. W. Barkway; Sqn. Ldr. C. K. Barrett; P/O. A. M. J. Bell; P/O. E. E. Boyle; Sqn. Ldr. C. G. Bull; W/O. G. F. Butson; F/O. F. P. Byrne; Flt. Sgt. W. A. Cameron; F/O. G. A. S. Cashion; F/O. E. R. Cumming; Sgt. R. N. Cunningham; P/O. D. G. Davis; P/O. P. Dewar; F/O. R. H. Dickinson; P/O. G. T. Douglas; Sgt. C. D. Duncan; P/O. G. R. Dunn; Flt. Lt. J. W. Einarson, D.F.C., D.F.M.; P/O. E. W. Eppler; F/O. L. M. Falkins; F/O. R. A. Faulafer; P/O. N. F. Fitton; F/O. E. W. Folliott; W/O. J. Friedt; P/O. E. J. Gares; W/O. J. E. G. Girouard; P/O. J. Z. Giroux; P/O. T. A. Goundrey; P/O. W. J. Gramson; P/O. E. C. Green; F/O. E. J. Hagen; F/O. A. H. B. Hall; Sgt. G. W. Hemming; P/O. R. E. Horton; Sgt. E. Houlden; P/O. D. Ianuziello; P/O. A. E. Irving; P/O. G. H. Isaac; F/O. E. C. Johnson; F/O. G. W. Johnson; P/O.

Group Capt. J. E. Johnson, D.S.O., D.F.C., the new C.O. of No. 124 Wing, chats to R.A.F. and W.A.A.F. personnel outside the Malcolm Club in Lübeck. The club is open to N.C.Os. and airmen of the R.A.F. and Allied air forces.

SERVICE AVIATION

W. K. Johnson; P/O. F. E. Joynson; P/O. C. Karrel; F/O. R. G. Kelso; F/O. G. S. Kimber; P/O. R. N. Kirkpatrick; P/O. C. H. Kyle; P/O. O. P. Lawson; P/O. J. W. R. Lefebvre; P/O. G. W. Lillico; P/O. J. E. Lockett; P/O. G. R. MacArthur; F/O. W. R. McClung; P/O. D. McCrae; Flt. Sgt. J. E. McGibbon; P/O. J. A. McKim; P/O. B. J. MacKinnon; F/O. R. W. McLaren; F/O. A. C. McLeod; F/O. D. M. Margison; F/O. H. McN. Martin; P/O. D. J. Miller; F/O. T. R. B. Millman; Flt. Lt. J. M. Mitchell; P/O. O. Molzan; Flt. Sgt. J. K. Morey; F/O. A. J. Muir; P/O. K. J. Murray; P/O. J. E. McI. Nixon; F/O. R. W. Offler; P/O. J. A. B. Ouimet; P/O. J. S. Owens; P/O. A. P. Pappajohn; P/O. J. B. Patterson; F/O. E. J. Pawlitza; F/O. F. E. Pickering; F/O. W. W. Proudfoot; P/O. H. E. Quinn; W/O. J. A. Reynolds; P/O. H. K. Rose; F/O. J. T. Sammon; F/O. A. M. Shannon; F/O. S. G. C. Sherman; P/O. R. J. Smith; Flt. Sgt. J. E. Smythe; Flt. Lt. L. B. Thistle; P/O. J. R. Truscott; P/O. W. W. Watson; F/O. W. H. Wilson; P/O. L. A. Wry.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. V. A. G. Brochu.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. A. J. Goldman.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. P. J. O. Lapointe; Sgt. F. C. Smith.

Royal New Zealand Air Force

KILLED IN ACTION.—P/O. T. A. Mallon; P/O. G. H. Brock.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. A. H. Bailey.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. O. J. McCabe.

South African Air Force

KILLED IN ACTION.—Lt. A. M. Hacker.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. W. S. Barret; Lt. H. H. Bounce; Flt. Sgt. D. H. Collins; W/O. D. T. Flynn; Capt. J. H. Gaynor, D.F.C.; Lt. D. J. S. Haggie; Lt. D. Lindley; Maj. J. A. Mouton, D.F.C.; 2/Lt. R. G. Southey.

WOUNDED OR INJURED IN ACTION.—2/Lt. R. Turner.

MISSING.—Lt. R. L. Chegwyn; Flt. Lt. D. D. O. Davies; Capt. L. J. De Jager; 2/Lt. I. B. Dell; 2/Lt. I. J. Doble; Lt. L. P. Fourie; W/O. J. N. Geldenhuys; W/O. L. Leyton; W/O. G. C. Mayhew; Lt. G. C. Nel; W/O. N. F. Odendaal; W/O. J. Robbertse; W/O. F. J. Slater; 2/Lt. P. M. Tylden-Wright; W/O. W. A. J. Venter.

Casualty Communiqué No. 537

Of the names in this list 189 are second entries giving later information of casualties published in earlier lists

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. L. J. Bence; Sgt. F. E. Carter; Sgt. A. D. Dodd; Flt. Sgt. F. C. D. Evans; Sgt. R. G. Herring; P/O. E. S. Jerome; P/O. I. L. Munce; Sgt. G. A. Reeve; P/O. W. T. Symes.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. Beech; F/O. A. G. Blake; Flt. Sgt. R. F. Cutler; Sgt. W. W. Forsyth; Sgt. J. R. Grint; Sgt. D. Harrison; Flt. Lt. A. J. Hay, D.F.C.; Sgt. L. A. Holt; Sgt. H. V. Hunt; Flt. Sgt. G. W. Lee; Sgt. J. Pilling; Flt. Sgt. D. J. A. W. Price; Flt. Sgt. A. J. Read; Flt. Sgt. G. R. Shannon; Flt. Sgt. A. W. Smith; F/O. J. E. Walton.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. J. P. Alcock; Sgt. J. N. Andrew; Sgt. F. N. Ansell; Sgt. R. F. Arnold; F/O. T. G. Atkinson; Sgt. A. W. W. Ayres; Sgt. J. Bailey; P/O. F. W. Baker; Sgt. R. B. Barker; P/O. D. Barr; P/O. C. Bell; Flt. Sgt. V. Bennett; P/O. C. A. Bishop; Sgt. N. R. Bishop; Sgt. K. S. Bolton; Sgt. E. E. Borton; Sgt. A. J. Bowles; Sgt. A. R. Braine; Sgt. R. Brimelow; Flt. Lt. P. R. Burt, D.F.C.; Sgt. F. W. Burton; Act. Flt. Lt. A. E. Carlton; P/O. S. Carlyle, D.F.M.; F/O. J. Caterer; P/O. A. E. S. Cooper; Sgt. G. A. Coote; Sgt. D. J. C. Cosgrove; Act. Sqn. Ldr. A. P. Cranswick, D.S.O., D.F.C.; Flt. Lt. J. S. G. Crawford; Flt. Sgt. R. J. Cross; Sgt. E. A. Cryer; Flt. Lt. G. E. Dunfee; Sgt. K. S. Eddie; P/O. N. J. Fisher; Flt. Sgt. J. J. W. Foster; Sgt. G. F. French; Act. Sqn. Ldr. L. H. Glasspool, D.F.C.; Sgt. N. M. Goldberg; P/O. A. F. Goodall; P/O. J. J. Gorman; Sgt. C. G. Graham; P/O. P. R. Graves-Hook; Sgt. R. A. Green; Flt. Sgt. E. W. Greenwood; Sgt. H. G. Hamilton; Flt. Lt. M. F. C. Harding; Sgt. N. Hatton; Sgt. H. R. Healey; Sgt. S. W. Higgins; Sgt. J. Hogan; Sgt. R. E. Hogan; Sgt. J. H. Holloway; Sgt. J. W. Hooper; Sgt. R. Howe; Flt. Sgt. L. F. Hughes; Sgt. W. T. R. Hunter; Sgt. E. H. G. Jackson; Sgt. E. G. Jones; Flt. Sgt. F. S. Jones; Sgt. H. C. Jones; Flt. Sgt. W. T. Jones; Sgt. J. P. Kenny; F/O. R. H. Kille; P/O. E. A. Kingham; Sgt. A. W. Kindred; Flt. Sgt. N. A. L. Lacey-Johnson; Sgt. R. Lane; Flt. Sgt. G. H. Little; F/O. F. J. Lynam; Sgt. S. McCallum; Flt. Lt. A. M. McEwan; Sgt. G. F. Marley; Act. Flt. Sgt. H. E. Martin; P/O. W. M. E. Myers; P/O. J. McD. Napier; Sgt. B. Orrick; Sgt. L. P. Oughton; Sgt. L. W. F. Overend; Sgt. J. H. Peake; Flt. Sgt. H. M. Peckett; Sgt. L. A. Pointer; P/O. D. C. Rippon; Sgt. W. B. Robertson; Sgt. G. E. Ross; Flt. Sgt. G. T. Ryan; F/O. R. A. F. Scrivener; Sgt. F. C. Searle; Flt. Sgt. H. T. Shaylor; P/O. L. H. Simpson; Sgt. R. A. Smith; Sgt. E. S. Sowersby; Flt. Sgt. C. G. Spencer; Sgt. R. D. Stack; Sgt. J. A. Stone; F/O. D. C. N. Sullivan; Sgt. K. R. Sumner; F/O. L. Sumner; Flt. Lt. D. E. Taylor; Sgt. G. N. Tebbutt; Flt. Sgt. O. Thomas; Sgt. R. H. C. Troake; Sgt. W. Upsall; Sgt. A. W. Wade; F/O. P. Wadsworth; Sgt. H. R. Warren; Act. Flt. Lt. W. H. Waycott; Flt. Lt. L. L. Whitaker, D.F.C.; Sgt. B. Whitehead; P/O. S. H. Willes; Sgt. G. W. Wilson; Sgt. J. J. Wilson; Flt. Sgt. S. Wilson.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. E. E. Smith.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. C. Edwards; Sgt. R. C. Rayment; P/O. A. Steainstreet; Sgt. R. Surtees.

MISSING.—Sgt. D. Anthony; F/O. R. Appleyard, D.F.M.; Flt. Sgt. G. R. Archbold; Flt. Sgt. N. P. Baker; W/O. J. E. Betton; F/O. D. C. Biggar; Sgt. G. A. Clarke; Flt. Sgt. V. C. Davidson; Sgt. K. G. Durston; Flt. Sgt. A. W. Ferme; Sgt. E. Finch; Flt. Sgt. J. K. Finlayson; Sgt. A. MacD. Forbes; Sgt. S. M. E. Fraser; Sgt. D. B. Godden; Flt. Sgt. A. E. Higgins; W/O. R. S. Howe; F/O. R. E. Hughes; Flt. Sgt. W. E. A. Jeffery; Sgt. D. B. Jones; Sgt. I. Jones; Sgt. W. S. Keenleyside; Sgt. W. T. H. Lowman; F/O. P. McCartney; P/O. P. J. Parsons; Sgt. A. R. Quinton; Sgt. A. K. Robinson; Sgt. E. R. Robinson; Sgt. F. E. Self; Act. Flt. Lt. P. Scott; Sgt. D. H. Sheppard; Sgt. K. J. B. Smith; Flt. Sgt. S. Stuart; Sgt. S. D. Wager; Sgt. W. Walker; Sgt. D. F. Wood; Sgt. K. Woodburn; Flt. Sgt. J. Wyatt.

KILLED ON ACTIVE SERVICE.—Cpl. J. B. Bailey; A/C.1 R. Banner; Sgt. A. Bligh; L.A/C. W. Bridgen; Sgt. R. A. Button; Sgt. G. A. Cain; Flt. Sgt. J. V. Etheridge; L.A/C. C. S. Hubbard; Cpl. F. Jeckells; L.A/C. E. Jones; L.A/C. D. Lindsay; Cpl. W. McKenzie; Sgt. P. E. W. Moore; Cpl. R. H. Moore; Flt. Sgt. R. H. Page; W/O. J. Pennack; Sgt. F. W. Ward; Sgt. H. A. Warman; Flt. Sgt. J. Whitthamn.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. E. H. Holden; Act. Sqn. Ldr. W. E. Nixon; Sgt. J. Payne; F/O. J. Seward.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. A. H. Allison; F/O. D. L. Davies, D.F.C.; P/O. B. O. Hunt; P/O. G. J. Scuffins.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.1 E. F. Asbury; Sgt. T. D. M. Shaxson.

DIED ON ACTIVE SERVICE.—Sgt. A. J. Ansell; L.A/C. J. T. Bailey; L.A/C. H. C. Fairbanks.

Women's Auxiliary Air Force

MISSING.—L.A/CW. J. P. Metherell.

Royal Australian Air Force

KILLED IN ACTION.—W/O. N. V. Ryan.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. D. Carne; F/O. A. W. Dawe; Act. Flt. Lt. F. E. McLean; F/O. R. W. Mercer; W/O. J. Rowe; W/O. R. G. Shipway; Flt. Sgt. G. A. Shoesmith; Flt. Sgt. R. T. Walker.

MISSING.—Flt. Sgt. R. C. Rhodes; P/O. P. M. Rolls; Flt. Sgt. C. J. Tarrant; Flt. Sgt. J. W. Teague.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. R. H. Gillian; Flt. Sgt. A. Wilson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. C. Grant.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. J. L. Atkinson; F/O. T. M. Campbell; Flt. Lt. I. Emerson; Sqn. Ldr. E. T. Garrett; F/O. A. M. Hutchison; F/O. H. D. Laronde; P/O. J. B. Linstead; P/O. J. N. MacDougall; P/O. H. B. McLeod; P/O. W. G. Miller; F/O. W. E. Nightingale; F/O. K. G. Parker; P/O. R. H. Turner.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. J. J. McV. Flood; Flt. Lt. W. G. Hoffman; P/O. C. A. Roberts; Flt. Lt. J. F. H. Williams, D.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. B. Bercuson; P/O. J. P. Birmingham; P/O. C. J. Blyth; Flt. Lt. J. A. L. Couture; Flt. Sgt. D. H. Culverson; W/O. L. W. Davies; P/O. M. E. Fairall; P/O. C. J. Foy; F/O. R. R. Giffin; F/O. H. Grimble; F/O. J. F. Harris; Flt. Sgt. G. T. Hodgson; Sgt. B. M. Hofforth; F/O. E. D. B. Jolley; F/O. E. C. Jones; F/O. S. N. Kwinter; P/O. H. A. Legary; F/O. M. L. G. Lovering; P/O. B. McLauchlin; F/O. R. B. Melville; F/O. A. M. Mills; P/O. P. A. Musgrave; P/O. R. K. Nelson; P/O. A. V. Nevin; F/O. C. F. O'Donnell; P/O. J. J. Pearson; P/O. D. W. Peers; Flt. Sgt. P. Peters; Sgt. D. A. H. Redshaw; Flt. Sgt. J. G. M. Savard; Flt. Sgt. T. R. J. Sinclair; P/O. T. B. Sparrow; F/O. A. Stienstra; F/O. W. A. Swinton; F/O. G. McL. Taylor; F/O. W. MacM. Taylor; P/O. A. Watt; F/O. M. P. Zimmerman.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. H. R. Dobbie; P/O. J. Low.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. P. S. Jennings; P/O. R. W. McKinnon; Flt. Lt. H. T. Mossip, D.F.C.; Flt. Lt. J. A. Thurlow.

MISSING.—Flt. Sgt. A. G. Allen; Sgt. W. G. Anderson; W/O. N. G. Baird; Flt. Sgt. E. V. Beach; P/O. H. G. Bishop; F/O. H. A. Coutts; P/O. G. D. Daughters; Wing Cdr. R. E. Davenport; F/O. T. M. Draper; F/O. T. L. Foley; W/O. C. W. Fraser; F/O. R. D. Harris; F/O. D. J. K. Hector; P/O. K. B. Hicks; P/O. C. R. Lecky; F/O. F. J. Klapkew; Sgt. J. Klem; F/O. T. S. Lawrence; Flt. Sgt. R. G. McManus; F/O. B. T. MacNeill; Flt. Lt. E. W. Martin; Sgt. R. L. Mitchell; F/O E. A. Oswald; Sgt. A. C. Pettifor; Flt. Lt. R. C. Ridge; F/O. W. Rink; F/O. D. W. B. Robinson; Flt. Sgt. S. Roau; Flt. Lt. C. L. Shaver; Flt. Lt. G. I. Sheldrick; F/O. W. E. Short; W/O. G. W. Stairs; F/O. D. A. Standfield; F/O. K. G. Thomas; Sgt. R. T. Wilson.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. W. A. Tustin; P/O. J. W. Wettlaufer.

KILLED ON ACTIVE SERVICE.—P/O. J. K. Andrews; P/O. C. J. Butler; Flt. Lt. E. V. Duckworth; F/O. I. L. MacFadyen; Flt. Lt. R. C. O'Connor; Flt. Sgt. J. H. Skinner.

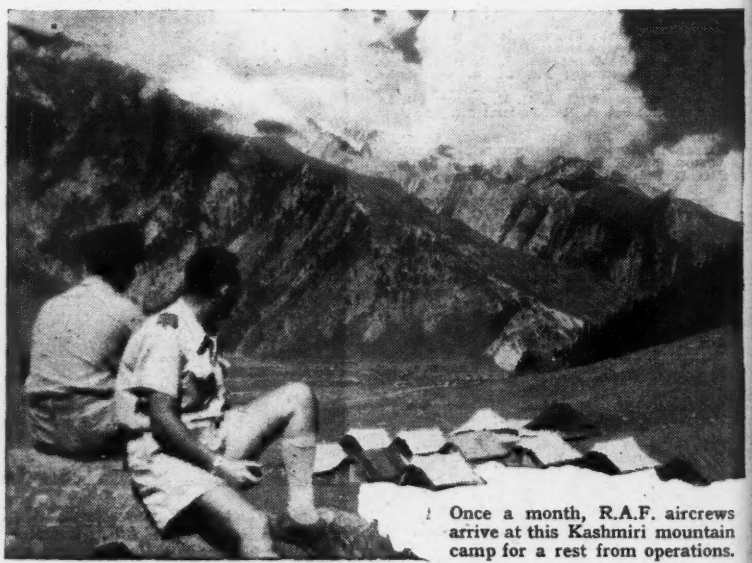
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. W. S. Bond.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O A. Izenberg.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. H. G Walters.

MISSING.—Flt. Sgt. M. Swap.



Once a month, R.A.F. aircrews arrive at this Kashmiri mountain camp for a rest from operations.

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